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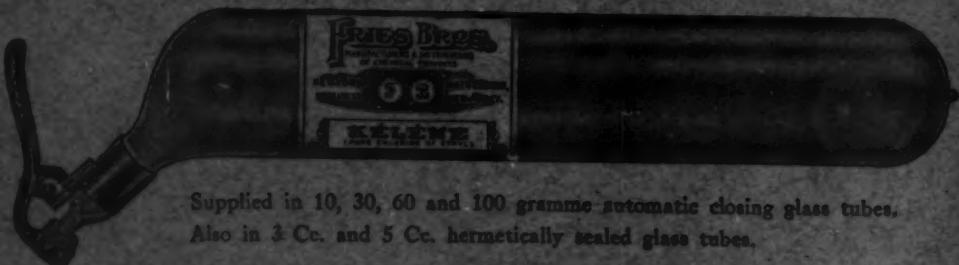
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DERMOID CYSTS OF THE MEDIASTINUM

BY HOWARD L. BEYE, M.D.

OF IOWA CITY, IOWA

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DERMOID cysts of the mediastinum are rare tumors, only 118 having been reported. They are, however, a group of intrathoracic tumors which may frequently be amenable to surgical treatment. For this reason it is desirable that an understanding of the life history and clinical aspects of these tumors should become general so that they may be given due consideration in the differential diagnosis of chest conditions.

CASE REPORT.—Male, schoolboy, age twenty. Entered University Hospital, July 11, 1922.

History.—Four years ago had an attack of pleurisy with effusion in the left side which subsided completely in one month. Two years later began to have stabbing pains on the same side which increased in the severity and duration of attacks over a period of several weeks. Immediately following an unusually severe attack which "doubled him up," he was operated upon for empyema, by rib resection. The discharge was thick, profuse and yellow. It gradually lessened in amount and became more serous in character, of a sour odor and irritating to the skin. A sinus has persisted following the operation. Ever since the onset two years ago, the patient has had occasional chills and an irregular fever which has reached 103. Cough has been a fairly persistent symptom. It often produces aropy, yellow sputum, small in amount and not foul. Has never spat up blood. Following drainage of the chest, the cavity was irrigated for several months until on one occasion the patient had a severe attack of coughing and choking, and tasted the irrigating fluid. There has been a loss of thirty-four pounds in weight and 50 per cent. of strength.

Past Medical History.—Negative except for the ordinary diseases of childhood and tonsillectomy eight years ago.

Examination.—The general examination was negative except for the chest. The latter was somewhat flattened in the upper half on the left side. A sinus was present in the left anterior axillary line over the seventh rib, from which discharged a greenish-yellow pus. The skin was reddened and tender. Dulness was present over the lower half of the chest in front and back and the breath sounds were very distant. No râles were heard. The right side was normal. The right border of heart dulness was undisturbed.

Laboratory Findings.—There was no leucocytosis; the von Pirquet and Wassermann tests were negative. A röntgenogram of the chest showed a dense shadow in the left from the fourth rib to the diaphragm. The upper border of this shadow was well outlined and slightly convex upward.

A diagnosis of chronic empyema was made.

Operation.—July 17, 1922. Nitrous oxide anaesthesia.

Three inches of the seventh rib was resected in the region of the sinus. The underlying pleura was very thick and tough. Upon incising it, some white, gummy material escaped from the cavity and was taken to be bismuth paste, although nothing in the history

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suggested that this material had been injected into the cavity. Several fine hairs were then seen to protrude through the opening. These led to the diagnosis of dermoid cyst.

The incision was enlarged and four inches of the sixth rib removed and the intercostal muscle between it and the seventh divided, together with the tough pleura. This exposed a cavity which was the size and shape of a large grape fruit. It extended from the antero-lateral chest wall upward, inward and mesially. No bronchial communication was seen. In places the cavity was lined by irregular areas of epithelium which resembled skin. This tissue was thick and tough and from its surface projected firmly attached hairs an inch long. The follicle openings in this skin-like epithelium were readily seen.

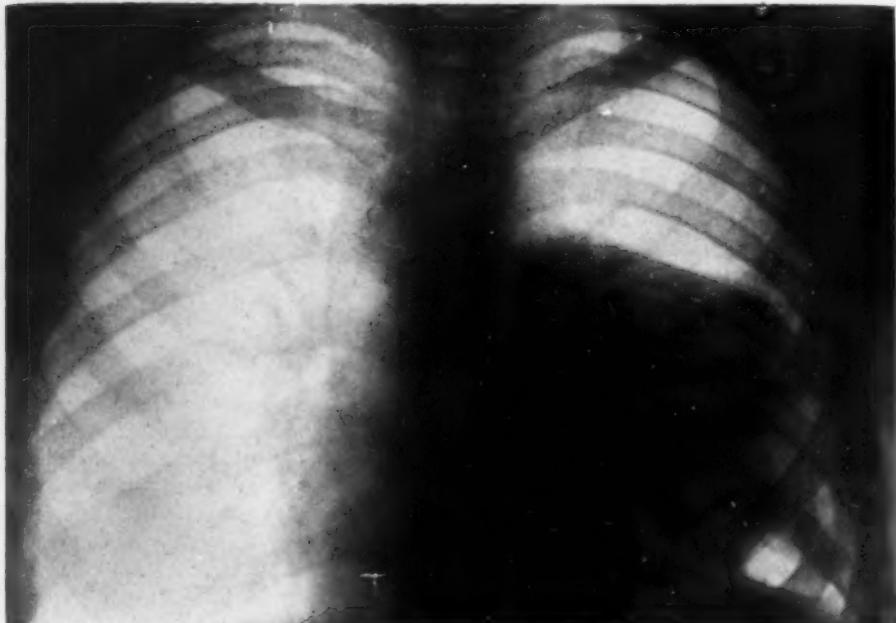


FIG. 1.—Röntgenogram of chest before operation.

The major portion of the wall of the cavity was lined by coarsely granular tissue which merged indefinitely with the epithelial tissue. It was purplish-red in color. The cavity was filled with pale yellow, homogeneous, cheesy material with fine light brown hair matted in it. The wall of the cavity was inelastic and moved very little during respiration. The pulsation of the heart against its mesial aspect produced definite excursion.

A complete decortication of the lining membrane of the cavity was technically impossible because of its great depth. The largest piece of epithelium, the size of a 50-cent piece, lay on the posterior wall and was removed by cutting. It did not strip off. Two smaller areas were also dissected away. The rest of the cavity wall was carefully curetted in an attempt to remove any remaining epithelial lining. The cavity was loosely packed with gauze and the incision partially closed.

No pleural irritation was manifested at any time.

Post-operative recovery was uneventful, the patient improved generally, gained 17 pounds in weight and left the hospital on the fifty-third day with a tube leading into the cavity. The latter had decreased somewhat in size.

Eleven months after his operation he returned because of a persistent sinus. He had continued to improve and was working daily on the farm. The cavity was still of large size but smaller than at the time of operation.

Operation.—June 14, 1923. Ether anæsthesia.

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An incision was made to circumscribe the sinus. A vertical incision was made at right angles to it and segments of the fifth, fourth and third ribs removed.

A cavity was present the size of an orange which contained a few loose hairs. It was completely lined by white, wrinkled skin-like epithelium from which projected many fine grayish hairs. It had the appearance of skin upon which a hot moist dressing has been applied for several days. The wall of the cyst was nearly a centimetre thick, extremely tough and was tightly adherent to the adjacent pericardium, lung and diaphragm. It lay deeply in the angle between heart and lung. Dissection was made by cutting with scissors in the line of cleavage. Several large vessels passed into the cyst wall from the visceral pleura. It was possible to remove the entire cyst wall and the sinus tract leading into it *en masse*.

The resultant cavity was partially obliterated by a few sutures taken in the angle between thickened pleura and pericardium. A gauze pack was then applied and the incision partially sutured.

Post-operative Course.

Uneventful recovery after a week of high febrile reaction. The patient returned home on the nineteenth day and the wound was healed completely at the end of four months.

Examination April 6, 1925, or nearly two years after removal of the dermoid cyst, disclosed a well-healed scar (Figs. 2 and 3), and no evidence of disease in the lung or pleura. He has entirely recovered and is working daily.

Histological Report.—Sections show a stratified squamous epithelium lining the cyst with all the elements of skin present; sweat glands, sebaceous glands and hair follicles. One part of the cyst is lined by a single layer of cuboidal epithelium. There are also traces of lymphoid tissue. In the wall of the cyst there are a few glands of uncharacteristic shape and appearance; these are lined by double layers of high columnar epithelium.

General Consideration.—Mediastinal dermoids occur at all ages, but the great majority of cases are found in patients between the ages of fifteen and thirty. There is no sex preponderance. In an occasional case a blow on the chest or an infectious disease has apparently incited the tumor to activity.

Symptoms.—Mediastinal dermoids present a symptom complex which is quite variable. The symptoms may be due to pressure of the enlarging mass upon the adjacent tissues or organs, or may be due to irritation of the tumor producing the clinical picture of an intrathoracic inflammatory process.



FIG. 2.—Site of operative approach is shown by scar. Photograph taken two years after operation.

The onset of symptoms is often insidious, extending over a period of months or years. Cough is the commonest initial symptom. It may be dry and hacking or productive of a glairy mucus or pus. Haemoptysis is not uncommon. This may be evidenced by blood-tinged sputum or it may be profuse and may lead to a fatal termination. Hair has been found in the

sputum in several cases, and in others there has been raised a fatty, glycerin-like matter containing cholesterolin crystals and also squamous epithelium.

Dyspnea is another common symptom, and may become extreme. Dysphagia may be present. Pain is sometimes the initial symptom or may occur later. It varies from an indefinite sense of substernal pressure to sharp and stabbing. It is usually referred to the location of the tumor.

The onset is less commonly acute, simulating pneumonia, empyema or pleurisy with effusion. The latter may develop and complicate the picture.

FIG. 3.—Site of operative approach is shown by scar. Photograph taken two years after operation.

Sometimes the acute symptoms will subside to be followed by exacerbations or a chronic course.

Fever, loss in weight and strength, and anorexia are common symptoms and chills may occur.

A visible swelling may develop with or without other symptoms. This may appear above the sternum in the midline, behind the clavicle, or produce a diffuse bulging of the chest wall on the affected side. When it approaches the surface above sternum or clavicle, it may have the boggy consistency of a wen, or suggest a cold abscess. In a few of the cases, the swelling has pulsated, due to intimate relationship with underlying blood-vessels.

In a few of the reported cases, there were insignificant or no symptoms produced by the mediastinal tumor, the latter being an incidental finding at autopsy.



DERMOID CYSTS OF THE MEDIASTINUM

The course may be very rapid or the symptoms may persist over a period of many years, but in a majority of the reported cases the patients succumbed in from one to four years after onset of symptoms unless successful treatment was instituted. In the unoperated cases death was commonly due to pulmonary hemorrhage, dyspnea, exhaustion or sepsis.

Diagnosis.—A mediastinal dermoid should always be considered in a patient with the signs and symptoms of a mediastinal or pulmonary tumor, especially if the patient is between fifteen and thirty years of age and the growth of the tumor is slow.

The tumor is usually of considerable size and is commonly in the upper portion of the thorax and to one side. It may, however, rest upon the diaphragm.

If a tumefaction is produced above the sternum or clavicle, it may have a boggy consistency as of a wen, which is an important diagnostic point. Hertzler⁵ made a correct diagnosis of his case on this finding.

The finding of hair in the sputum has led to the diagnosis in several cases. Sputum containing a fatty or glycerine-like substance, or squamous epithelium is highly diagnostic.

Aspiration of the tumor may obtain hair and the diagnosis thus be positively established, as in Harris' case.⁶ The finding of an oily yellow material containing cholesterol crystals or squamous cells would be strongly diagnostic. When, however, the presence of a dermoid is suspected, it is questionable if aspiration of the tumor is indicated. Thoracotomy would be a preferable procedure.

X-ray and fluoroscopic examination may show a well-outlined spherical shadow surrounded by normal lung, and with no expansile pulsation. Calcification of the wall of the tumor might be demonstrable in an exceptional case. The finding of tooth-like shadows in the shadow of the tumor itself would be significant. Typical X-ray findings would be greatly masked in cases with an effusion into the pleural cavity.

Differential diagnosis must include all cases of solitary intrathoracic tumors, aneurism, and pleural and pulmonary infections. Many of the cases were considered to be pulmonary tuberculosis based on the symptoms of cough, loss of weight and strength, fever and haemoptysis. In this connection it should be noted that in a few cases there has been shown at autopsy an active pulmonary tuberculosis in addition to the dermoid. Pleurisy with effusion or empyema may be diagnosed and these conditions may also complicate the picture in the presence of a dermoid.

Pathology.—The tumors are spherical in outline. In size they vary from that of a hen's egg to a mass which fills one side of the thorax. The position varies greatly. A majority lie in the upper half of the mediastinum anteriorly and just behind the sternum. Here the mass may extend upward to protrude in the suprasternal notch. The tumor may extend to one side or the other, displacing the lung, and may appear behind or above the clavicle.

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Less commonly the tumor is situated in the lower portion of the mediastinum, pushing its way into the pleural cavity between lung and pericardium, and resting upon the diaphragm. The whole pleural cavity may be practically filled with tumor.

Rarely the mass is found embedded in lung substance.

It is the relationship between these tumors and neighboring structures which is the chief concern in consideration of surgical treatment. The tumor is commonly in close contact with the large vessels in the upper mediastinum and often adherent to them. It may be more or less densely adherent also to lung, pericardium, sternum, chest wall or diaphragm. These adhesions to important structures and at great depth may make complete extirpation of the tumor impossible.

Erosion into the lung with establishment of a bronchial communication is fairly common. Further increase in growth of the tumor does not seem to be affected by the formation of a bronchial fistula. In one case the wall of the aorta was eroded and in another case the pericardium was entered by the tumor.

Effusion into the pleural cavity is not an uncommon complication and the cavity may become infected. Tuberculosis of the lung may be an associated condition.

Structure.—In the simplest form the tumor is made up of a single cyst with a well-developed fibrous tissue capsule and lined by stratified epithelium with hair follicles and sweat and sebaceous glands. In this type, considerable relief may be obtained by simple drainage if total extirpation is not feasible.

The tumor may consist of multilocular cysts, independent, or communicating with one another, and polypoid growths may be found extending into the cysts. The structure may be fairly complex, with areas of cuboidal or columnar epithelium, bone plates and cartilage, or even teeth buried in the walls or lying in the cavities. Areas suggesting thymus or thyroid may be found. The content of these cysts consists of an oily liquid or a greasy salve-like material containing hair in various quantities.

Tumors have been reported which contained well-formed bone resembling a superior maxilla, elements of the intestinal tract, striated muscle and nervous tissue. Solid teratomata make up a small group of reported cases. Malignant degeneration, carcinomatous or sarcomatous, has occurred in a few cases, with or without metastasis.

Genesis.—“A single origin through one-sided developments of teratomas cannot be excluded for the entire group. Yet most authors regard the simple tumors as derived from the third branchial arch which produces the deep sinus cervicalis and the thymus. The intimate relations of ectodermal and entodermal layers of the third and fourth arches may explain the variety of the epithelium and the connection with the thymus and thyroid; while the descent of the heart may carry these structures deep into the thorax. Der-

DERMOID CYSTS OF THE MEDIASTINUM

roids of the lower mediastinum may result from imperfect closure of the anterior chest wall." (Ewing.¹).

Treatment.—Exploratory thoracotomy is indicated in any patient who is suffering from an intrathoracic condition, the diagnosis of which is obscure, and in which a dermoid is a possibility.

The ideal treatment is total extirpation. This may be impossible because of the situation of the tumor or because of the character of the adhesions which bind it to vital structures. Fortunately, however, even with the largest tumors which have produced marked symptoms of pressure, the attachments are frequently very loose and easily broken down.

Where the tumor is so large or so adherent or so situated that its removal is not practicable, drainage is indicated. This will accomplish most in the single cyst tumors. Drainage may be followed by a cure. In other cases, as in the one reported above, the tumor will become smaller and its removal may be attempted later with greater technical ease and with less danger to the patient.

In some of the cases drainage has been followed by a persistent sinus and in others the procedure has proven fatal. It is difficult to see how drainage will accomplish very much in the complex multilocular cysts, and in this group one would be justified in taking a greater risk in making the attempt at complete extirpation.

Following complete removal of a dermoid, a large cavity may remain which will be slow to become obliterated, due in large measure to the atelectatic condition of the compressed lung. Plastic procedures may prove necessary to obtain a cure.

Of the 119 reported cases (including the above case) 57 (47 per cent.) have been operated upon by drainage or removal of the tumor. The following results were obtained in the 57 cases: Recovery, 22 (37 per cent.); improved, 17 (30 per cent.); not stated, 5 (10 per cent.); died, 12 (22 per cent.). These figures show that of the operated cases over two-thirds were cured or improved, and that, while the operative mortality of 22 per cent. is high, the risk of operation is not out of proportion to the chance of relief which may be given in otherwise hopeless cases.

SUMMARY

Dermoid cysts of the mediastinum are rare tumors. Patients suffering from such tumors may be cured or relieved by operation.

These tumors may be diagnosed in some cases by positive signs or symptoms.

Mediastinal dermoids should be given due consideration in the diagnosis of all cases suggesting intra-thoracic new growths or obscure infections.

Exploratory thoracotomy is indicated when the diagnosis of a mediastinal dermoid is suspected.

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HEMIGLOSSECTOMY BY ENDOOTHERMY IN CARCINOMA OF THE TONGUE

BY GEORGE A. WYETH, M.D.
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IT is difficult to overemphasize the importance of sound pathology to successful surgery, but not all of surgery's failures can be laid at the door of faulty pathology. Too often the weakness is in the operation itself, and surgeons, realizing this, are interested in the details of improved technic, even as many have accepted in the treatment of malignancy the various physical measures which promised either relief or cure without certain of the concomitants of operation by the scalpel.

Although little is known of the definite cause of cancer, enough is understood of the different forms in which the disease manifests itself and of its varying degrees of virulence (a variation well indicated in Broders' system of one to four gradation) to convince us that it should be discussed in particular. It is too large and too special a subject on which to generalize.

This paper seeks to direct attention, therefore, only to the progress being made in the treatment of malignancy in the oral cavity, to the advance shown in recent work in the destruction and removal of cancer of the tongue and floor of the mouth by endogenous heat. We know that buccal cancer has a tendency to metastasize early and tends after removal by the scalpel to recur in or near the original site as well as to develop a malignant recurrence along the line of the scalpel's incision.

For reasons which are not very clear, cancer lesions of the mouth are often not brought to the attention of the surgeon until practically inoperable by ordinary methods. Interesting figures on this subject have been collected by Simmons,¹ who reports that Bloodgood found in a series of cases of cancer of the mouth that 50 per cent. had received poor advice from the first physician consulted. Farr,² of the New York Hospital, found that 66 per cent. had received poor first advice.

Metastases and recurrences are in no other part of the body more menac-

¹ Simmons, C. C.: Cancer of the Tongue and Mouth. Amer. Jour. Roentgenol. and Rad. Ther., N. Y., 1925, vol. xiii, p. 545.

² Farr, C. E.: Delay in Treatment of Cancer. Am. J. M. Sc., Phila., 1925, vol. clxiv, p. 712.



FIG. 1.—Blood-vessels have been ligated on left side. Retraction suture inserted on sound side of tongue. Allis clamp grasps diseased side at tip. Tongue is drawn forward. Beginning at base of tongue, well beyond lesion, isolating line of coagulation is drawn.

ing than in cases involving the mouth and buccal surfaces, one reason being that they here represent in addition to their own malignancy an interference with normal diet which the patient can ill sustain. In this region every need of the patient calls for immediate removal of the lesion in a single operation, and it is for this reason that the use of radium for cancer of the mouth and tongue is less generally recommended than was the case ten or even five years ago. The reaction from the employment of radium in mouth conditions being highly painful, and it being necessary to wait for many weeks for any accurate observation as to whether or not the malignancy has been destroyed, the profession has felt that, in comparison, surgery with its promptness was much to be preferred.



FIG. 2.—Path of coagulation necrosis is continued down midline of tongue by thrusting needle through and through the tongue.

is tantamount to deliberately forfeiting always their best chance and frequently their only chance of cure."

In endotherapy we have a refinement of surgery which adds to promptness of removal of the malignancy in a single operation, the advantage which inheres in its excision as dead tissue instead of as a mass of viable cells. By the technic of endotherapy the malignant area is isolated by a line of protective necrosis drawn in healthy tissue surrounding the lesion. This line seals off the lymph channels and blood-vessels by which cancer cells are disseminated and severs and caps the sensory nerves. The malignancy is then attacked *in situ* and coagulated by the bipolar current, after which it is excised as a dead mass by the endotherm knife.

In a brilliantly informing article in *Minnesota Medicine* for January, 1925, on "The Relative Values of Surgery and Radiotherapy," W. J. Mayo says, "Modern operative procedures not only remove diseased tissue, but also the path by which the malignant cells reach locations beyond primary focus. Operation removes, in a block, the lymph-nodes adjacent to the growth."

We conceive this to be the purpose and high aim of surgery in malignancy but surely the metastases which often follow operations by the scalpel, and the frequent implantation of malignant cells along the line of the scalpel's incision are evidence enough that the ideal is not always realized.

Pointing out that only particles of molecular size, such as sugar, the amino-acids, and other crystalloids, are absorbed directly through the vascular

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capillaries of the body, while colloids and large particles are picked up by the lymphatics, Doctor Mayo says: "Bacteria and malignant cells do not pass directly into the capillaries but are carried by phagocytes into the lymphatics which are a closed system of vessels."

Hence the danger of mechanical dissemination which lies in the scalpel's severance of these lymphatics from a malignant area, and the advantage to the operator and the patient inheriting in the proper employment of endotherapy.

Clayton-Green, as reported in the *Proceedings of the Royal Society of Medicine*, 1921-22, says: "It was my great dissatisfaction with the results obtained by the ordinary operative methods in carcinoma of the tongue, tonsil and floor of the mouth which led me to adopt diathermy" (bipolar endotherapy) "as an alternative."

Cumberbatch of St. Bartholomew's Hospital, London, reporting the successful use of electrothermic methods in cases of malignancy of the mouth, concludes that even if the final results of the method were no better than those given by cutting operations, the quickness of the new method, the absence of bleeding, the relief of pain, the rarity of complications, the absence of shock, and the very short stay in bed with little discomfort would render high frequency currents a formidable rival to the knife in the treatment of malignant disease. He finds, too, the soft, non-contracting scar which results from the electrothermic operation one of the great advantages.

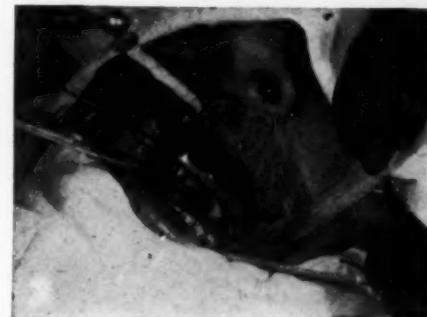


FIG. 3.—This isolating path of destruction seals lymphatics as it is produced and is carried to the tip of tongue, coming out between retention suture and clamp.



FIG. 4.—Elevating tongue, circumvallation is carried along under side of tongue, including floor of the mouth, if indicated.

used this method entirely for the past eighteen months with much better results than I ever obtained with the knife alone."

Claude Saberton wrote, in *The British Medical Journal* in 1921: "We operate upon all diseases of the tongue and floor of the mouth by the diathermic method, believing that any case operable by ordinary methods is much better treated by diathermy, and also that it is possible to remove successfully some growths otherwise inoperable. The removal of a malignant tongue by

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this method is quicker than by the use of scissors or scalpel and is a less formidable proceeding. Other advantages are: a bloodless field of operation, diminished sepsis and septic absorption, and rapid convalescence. Since October, 1918 (approximately three years), we have operated on 12 cases of malignant disease of the tongue. Up to the time of writing no local recurrence of the disease has occurred in any of the cases. . . . Diathermic removal of a malignant tongue is followed by cessation of discharge, relief of pain and rapid improvement in the general health."



FIG. 5.—Shows distinctly the white line of coagulation which has capped the sensory nerves and is continued to the starting point.

taught me how serious a factor is the subsequent shock and how often it paves the way for sepsis which may result in secondary hemorrhage or septic pneumonia. I can appreciate to the full the value of diathermy in this regard, for in none of my cases has there been any serious degree of shock and all have recovered in a few hours from the immediate effects of the operation. In the first place it is a bloodless operation, or nearly so. In a few cases there is slight bleeding but this is usually easily arrested by the further application of the electrode to the bleeding spot. . . . The advantage of this in simplifying the operation and diminishing the risk run is obvious, for the operation can be carried out with precision in mouth and throat cases, there is no fear that blood and septic material will reach the lungs, and the patient is necessarily better for the absence of the loss of blood. Further, the freedom from loss of blood largely contributes towards what is undoubtedly the greatest advantage of diathermy over a cutting operation, namely the absence of shock and collapse."

It will be observed that in all these quoted extracts our British colleagues refer to surgical diathermy, the bipolar, coagulating current being the one introduced to their attention by Nagelschmidt in 1910. Nagelschmidt employed a blunt electrode and that type of applicator is still in general use among the operators who follow his technic. But although the general employment of high frequency



FIG. 6.—Specimen is now taken for the microscope with tissue gouge, after which complete coagulation *in situ* of left side of tongue (and floor of the mouth if indicated) is begun.

ENDOTHERMY IN CARCINOMA OF THE TONGUE

currents in surgery in England and the Continent is practically limited to the bipolar current applied through a button electrode, enough has been quoted to show that our colleagues overseas are obtaining results in cancer surgery in advance of what is possible to operators who use the scalpel alone. Confirmation of their experience comes to us from Crile, whose conclusion, expressed in an article in the *New York State Medical Journal* for November 15, 1925, is "The most efficient method for destroying an early cancer of the tongue is electric coagulation or cauterization with the actual cautery. Radium would suffice to destroy the growth, but the radium burn is exceedingly painful." Kelly, developing endothermy in the removal of cancer of the breast, and in general accessible malignancy, writes in *The Medical Journal and Record*, July, 1925, "I welcome this new method (endothermy) as a great addition to our technic, not only enabling us to do some things better, but greatly enlarging our field of beneficent activity. I give the Wyeth sector the leading place and decided preference in my daily work, relegating the scalpel to a subordinate position." What is meant by correct endothermy technic is developed later. First we would say a word as to what endothermy is.



FIG. 7.—Coagulation is produced from midline outward to edge of tongue. Again going over the entire diseased half to assure thorough coagulation. Up to this point the bipolar current has been used exclusively, 1,000 to 1,500 milliamperes.



FIG. 8.—By one turn of a switch the cutting current (endotherm knife) is now brought into play. With the same needle an incision is begun slightly to left of midline at tip of tongue between retention suture and the clamp.

Endothermy is the surgical application of high frequency currents. It is the production of heat in the tissue from within (endogenous heat) in response to the many oscillations of a high frequency current, and the application of this heat to surgery.

Endothermy is not cauterization, for it does not burn. It is not fulguration nor diathermy. The term is a comprehensive one, including, as it does, all forms of the surgical application of high frequency currents, namely: the production and use of the

monopolar current to cause desiccation of tissue; the production and use of the bipolar current to cause coagulation (surgical diathermy); the production and use of the cutting current by which is accomplished a molecular dissolution and a thin line of coagulation which seals lymphatics as it cuts.

Of the three currents provided in endothermy the first named, the monopolar, is the one most often employed. It is applicable to that long list of

lesions which are accessible and which have extent but only slight depth. The destruction accomplished by the monopolar current (like the other currents of endothermy) is entirely under the control of the operator who can so throttle down the current as to remove a growth from the conjunctiva

without injury to the vitreous chamber, or, with equal precision, to dehydrate a small tumor of the vocal cord.

It is the monopolar current which is employed for the desiccation and removal of patches of leukoplakia, that so resistant condition which, being generally present in cases of malignancy of the oral cavity, has come to be considered a precancerous condition. Monopolar endothermy is efficacious in the removal also of those small cysts, ranulas, benign giant-cell and angiomas which offer such difficulties to excision by the scalpel.

FIG. 9.—With tongue elevated this incision is continued backward through the dead tissue of the tongue, along under side until starting point is arrived at.

tumors (epulis), fibromas, papillomas

and offer such difficulties to excision by the scalpel.

Bipolar endothermy, the method using the deep-penetrating coagulating d'Arsonval current of comparatively low voltage and high amperage, offers a wide extension of high frequency usefulness in the treatment of accessible neoplastic diseases. There are many variations of application in bipolar endothermy, depending upon the character of the lesion to be destroyed and its location. Since the only effect of the current is the production of heat in the tissues from within (the effect is not electrolysis) the sharp-pointed electrode may be of any suitable metal, but it has been found that the range offered by steel sewing or darning needles is ample for our needs. If the coagulation is not to be extensive, and not on highly resistant tissue, a fine needle is used; if heavy destruction is desired, a heavy darning needle may be employed. This is held in an insulated handle (Wyeth).

Tissue treated by the coagulating current of bipolar endothermy undergoes a very different change from that experienced by tissue which has been dehydrated by the monopolar current.

The lighter current (Oudin) dries out the cell without destroying cell outline. To this change Clark has given the name desiccation. Asnis has called it mummification necrosis. Treated by the heavier current of bipolar endothermy the tissue loses all semblance of cell structure in coagulation.



FIG. 10.—Shows the epithelioma now being immediately removed by the Allis clamp as a necrotic mass instead of as a group of viable cells. If operation is properly done there should be no bleeding.

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The third current of endothermy, the cutting current, of exceedingly high frequency, ruptures the cell structure, incises by molecular dissolution. The line of incision is marked on either side by a slight thickness of coagulation the advantages of which are understood when the importance of sealing lymphatics and capping nerve endings is considered.

Endothermy is technic as well as the application of current, and it is largely through the development of a procedure which combines effectively the bipolar and the cutting currents in the removal of malignancy of the buccal surfaces that endothermy's record has been made. Its application to the treatment of malignancy in the oral cavity will be developed in case reports to appear hereafter.

According to Broders³: "The most important factor in squamous-cell epithelioma . . . seems to be the degree of cellular activity. The grading was made on a basis of 1 to 4 and absolutely independently of clinical history. If an epithelioma shows a marked tendency to differentiate, that is, if about three-fourths of its structure is differentiated epithelium and one-fourth undifferentiated, it is graded 1; if the differentiated and undifferentiated epithelium are about equal, it is graded 2; if the undifferentiated epithelium forms about three-fourths and the differentiated about one-fourth of the growth, it is graded 3; if there is no tendency of the cells to differentiate, it is graded 4. Of course the number of mitotic figures and the number of cells with single, large, deeply staining nucleoli (one-eyed cells) plays an important part in the grading." Elsewhere Broders states:

"The mitotic figures and the one-eyed cells are undifferentiated cells and really should be considered only as such. However, when mitotic figures are numerous, especially if they are



FIG. 11.—Three weeks after operation. Note how nature has already begun to restore lost tissue.

of an irregular nature, one is inclined to raise the grade to some extent."

It will be seen at once that in comparison with the definiteness of this classification the case records as kept generally in office and hospital work are inconclusive. Unless some such system of grading by degree of malig-



FIG. 11.—A clean, dry wound. Retention suture removed. No dressing applied. Mouth wash prescribed.

³ Broders, A. C.: Squamous-cell Epithelioma of the Lip. A Study of 537 Cases. J. A. M. A., March 6, 1920.

nancy is adopted, it will be impossible properly to evaluate statistics submitted for our consideration.⁴

It is assumed that the operator is familiar with the pathology of the two types of carcinoma of the tongue, the papillary and the infiltrating. The former is elevated above the surface of the tongue, and in its destruction and removal the monopolar current is effective. The use of the more penetrating current here is entirely unwarranted, and to do a hemiglossectomy or a Blair

operation for complete removal with glands in such a case is to cause needless mutilation.

Given a case of infiltrating carcinoma of the tongue we are warranted in deciding upon a hemiglossectomy for its removal. We believe one advantage of performing this operation by the endothermic method lies in the fact that, because destruction is destruction, destruction and removal of the virulent Grade 4 epithelioma is as sure by this method as is the destruction and removal of



FIG. 13.—Case F. H. Photomicrograph of squamous-cell epithelioma of tongue. Grade 2.

the milder Grade 1 epithelioma, provided metastasis has not already taken place.

The Operation.—Hemiglossectomy begins in the neck. An incision is made with the endotherm knife along the anterior border of the sternomastoid muscle. The lingual artery is ligated. We have also learned that it is wise to ligate the facial artery as well, since there are a few small branches that run from it to the base of the tongue and these may cause annoying hemorrhage. To prevent a possible subsequent troublesome collateral circulation, the external carotid artery is likewise ligated.

If any movable, non-painful, hard lymph-nodes are present, with the characteristic indurated "feel" of cancer, indicating that the glands are already carcinomatous, they are now dissected by the endotherm knife. Our conviction is that routine block dissection is as unwarranted as it is

⁴ Our own records are kept according to the Broders gradation. It will be noted that no tables of percentages are included in our report of cases, the reason being that in the less than five years during which this branch of surgery has engaged the writer's attention there have not been treated a sufficient number of cases of the different grades of malignancy to make such a table valuable.

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futile, exposing the patient unduly to the danger of recurrence by tearing down nature's own wall of protection and at the same time opening wide the lymphatic channels. However, if the glands are to be excised, it had best be done by the endotherm knife, which seals lymphatics as it cuts. Small cigarette drain is inserted and the wound is sutured and heals by first intention. According to Kelly and Ward⁵ this primary union following incision by the endotherm knife is possibly promoted by the sterilization of the skin edges which is incidental to endothermy.

Turning our attention now to the lesion itself, we adjust the mouth gag and set the retraction suture transversely through the healthy side of the tongue. It is never necessary to split the cheek. With a darning needle bent to the proper shape, insulated by a strip of adhesive tape and held in a suitable handle, the malignancy is isolated by a path of protective coagulation necrosis. This is done beginning at the base of the tongue, well beyond the growth and working forward by thrusting the needle through the whole thickness of the tongue, point after point, along the midline to the tip. The tongue being elevated is next attacked from the lower side, taking in the floor of the mouth if necessary, until the starting point is reached and the coagulation path circumvallates the lesion. Specimen is now taken for the microscope, after which the entire indurated area is coagulated *in situ* by bipolar endothermy. With one turn of the switch the cutting current is brought into use and the coagulated mass is excised by passing the needle down the middle of the circumvallating path of protective necrosis already described. There is no bleeding, no surgical shock. An antiseptic mouth wash is prescribed and the patient is usually able to take liquid nourishment on the next day. A week later the stitches are removed from the neck, it being our custom to leave them in, after suturing an incision by the endotherm knife, for two or three days longer than is necessary after a scalpel incision.

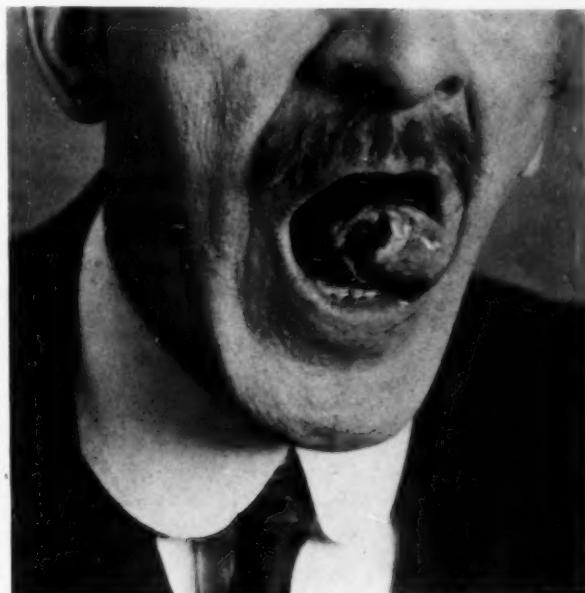


FIG. 14.—Case E. L.

⁵ Kelly, Howard E., and Ward, Grant E.: The Radical Breast Operation with the Endotherm Knife and without Ligatures. *ANNALS OF SURGERY*, January, 1926.

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Treatment by bipolar endotherapy of a case of squamous-cell epithelioma, grade 2, of the floor of the mouth is illustrated by the Case J. W., age sixty-six, a sailor, referred by Dr. W. B. Moodie. Patient had noticed a soreness on the right side of lower jaw which he attributed to friction from a dental plate. His dentist assured him this was not the case and patient thereupon paid scant attention to the lesion. Not for some months did he seek medical aid. Then he went to a New York hospital where "the doctor opened it, and since then it has had a hole in it." Examination showed an indurated mass, about 3 cm. x 2 cm. in size, involving the right side of the floor of the mouth, with no palpable glandular enlargement. On June 2, 1921, under ether narcosis, the

entire mass was isolated from the surrounding healthy tissue by a line of coagulation. The bipolar current was used and in this case it was necessary to coagulate through the frenum, the under surface of the tongue and the inner surface of the right jaw. A section for microscopic examination was then removed with impunity, after which the whole mass was coagulated *in situ*. This coagulated mass was next removed by scissors and the cavity seared over lightly with the bipolar current to produce a further penetration of the endogenous heat. (To-day



FIG. 15.—Case J. D.

this excision would be accomplished not by the scissors, but by the endotherm knife. In 1921, the cutting current had not yet been perfected.) Patient returned to room in good condition.

Next day there was considerable swelling of tongue and a profuse flow of saliva, but patient was free from pain and was able to take liquid nourishment. He left the hospital on the third day in fairly good condition, although toxic absorption had rendered him cachectic in appearance. Both sides of neck were given thorough X-ray radiation, and in four and one-half years there has been no recurrence nor metastasis.

CASE W. W., age fifty-three, squamous-cell epithelioma of the tongue, recommended for treatment by endotherapy by Professor John A. Fordyce, was operated upon by the writer March 11, 1924, in conjunction with Doctor Whipple, who ligated the lingual artery. *Presbyterian Hospital history*, No. 59,379, is abstracted to provide the following report:

Patient showed on right side of tongue an ulcer 1 cm. in diameter, with the hard, curled edge characteristic of malignancy. Leukoplakia was present and the submaxillary nodules were swollen and somewhat tender. He had previously had salvarsan treatment without benefit. Wassermann reaction negative. After ligation of the lingual artery, the patient being under ether narcosis, endotherapy was employed to perform a partial glossectomy. The circumvallating wall of destruction was begun at the back of the tongue and the lesion was isolated before being destroyed by bipolar endotherapy and excised by the endotherm knife. Recovery was uneventful and eighteen months after the operation patient reported that his only complaint was that he was "putting on too much weight." There was no sign of recurrence or metastasis.

The case of F. H., squamous-cell epithelioma, grade 2, of tongue, illustrated here-

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with, was referred by Dr. Floyd Fischer. Several years previously a dentist had injured the under side of the tongue in extracting a tooth. This healed within a month and caused no further trouble until six weeks before patient's visit to the surgeon. Consulting a druggist about the soreness which developed at that time, patient was given a mouth wash "which burned it." Patient then consulted Doctor Fischer, who took a biopsy, and received from the Long Island College Laboratory, the diagnosis of squamous-cell epithelioma of the tongue. The left side of tongue was indurated about an ulcer with a crater-like centre. Submaxillary nodules and a sublingual gland on either side were slightly palpable, distinctly larger on the left side. February 26, 1925, the case was operated upon, under ether narcosis, and two days later patient left the hospital. On the 21st of March the mouth lesion was completely healed and neither then nor at patient's next visit in April were any glands palpable. For certain reasons no radiations were given the glands of the neck. On the 18th of July, however, the left sublingual and submaxillary glands were palpable and on the 21st, under local anaesthesia, were dissected out by the endotherm knife, without hemorrhage. The wound was sutured, leaving a cigarette drain. Pathological report on these glands was: Chronic inflammation; no evidence of malignancy. Operation was followed by Röntgen-ray radiation to both sides of the neck.

In Case E. L., age fifty-one, epithelioma of tongue, the lesion had begun as a small pimple, the exact nature of which the physician was unable to determine. He suspected syphilis, tuberculosis or cancer. A Wassermann reaction was taken and when the report came back "four-positive," anti-luetic treatment was instituted. There was no response to the first salvarsan treatment, so the physician became more energetic in its administration, and during six weeks he gave the patient eight injections! The lesion had continued for three months and had reached the state shown in Fig. 14 before it was brought to the attention of a cancer specialist.

Bipolar endotherapy was prescribed and applied under chloroform anaesthesia on March 29, 1922. The malignancy was isolated by a line of coagulation necrosis drawn across the tongue, well behind the lesion, and the entire isolated mass was coagulated and excised. Blood-vessels, lymphatics and sensory nerves were sealed off; there was no hemorrhage and no surgical shock.

Patient developed an acute psychosis and died on the tenth day. The lesson is to the family physician or general practitioner. Any lesion inside the mouth which resists treatment for more than three weeks should without further delay be brought to the attention of the specialist. It is well known that many cancer of the mouth cases are syphilitic, but a positive Wassermann reaction is not the only thing to consider in prescribing treatment.

H. F. W., a case of squamous-cell epithelioma, was referred by Dr. James T. Pilcher, with a history of swelling under right tongue of three months' duration; patient



FIG. 16.—Case J. D.

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was referred for treatment by endotherapy after Doctor Pilcher had dissected out the glands on the right side of his neck.

October 4, 1924, the patient under rectal anaesthesia, the lesion was first circumvallated by bipolar endotherapy, destroyed *in situ* and then excised by endotherm knife. On the fourth day the man left the hospital and was cared for at his home. On two occasions upon the separation of eschars, sharp hemorrhages occurred which were controlled by packing. Prophylactic X-ray radiation was given both sides of neck. Patient began to gain at once, he returned to his work and his condition continues good with no sign of recurrence to date of this report.

The effectiveness of the monopolar current, rightly used, in removing papillary outgrowths on the tongue, is illustrated by the case of J. D., age fifty-five. At the time of examination, the patient showed a wart-like growth projecting one-eighth inch above the dorsal surface of the tongue. It was white, corrugated and hard to touch. There were palpable submaxillary nodes and sublingual glands. The specimen for the microscope showed squamous-cell epithelioma, grade 1. Under local anaesthesia the growth was dehydrated in a single treatment and removal as dead tissue.

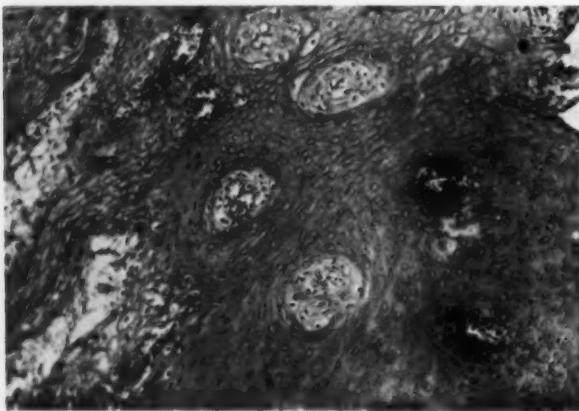


FIG. 17.—Case J. D.

the patient was referred for Röntgen-ray radiation, he wandered away and did not attend to it. The second photograph was taken two years after the operation when chance brought the patient again to our notice. His general condition is excellent and there is no evidence of recurrence of the disease. This case is of interest not only as illustrating the effective destruction which may be accomplished by wise use of monopolar endotherapy, but also as showing that glandular enlargement is not always a sign of glandular malignancy. These glands were almost certainly inflammatory in character and with the removal of the irritating mouth condition their swelling subsided, although two years later they were still slightly palpable.

It is a multiplicity of experiences like this one which leads us to conclude that bloc removal of glands of the neck as a routine part of the treatment of malignancy of the mouth and buccal surfaces is not warranted.

Combinations of endotherapy with other agents in treating malignancy are often indicated, but that radiologist who announced that he had employed endotherapy to clean out a mouth lesion after six weeks of treatment by radium seed implantations had missed the point of what endotherapy offered his patient. We believe that the radium seed implantation represented the unjustifiable exposure of the patient to infection, septic absorption and toxæmia; the infliction of needless suffering; the loss of critically valuable time; the delayed return to full diet; and, finally, that there could be no certainty of the success of the dosage. Against this pain and delay and uncertainty the doctor had in endotherapy a method which would have been

ENDOTHERMY IN CARCINOMA OF THE TONGUE*

prompt, cleanly, painless and exact. He was content to give his patient only a minimum of service from it while adhering closely to the old radium, tissue-conversion method for the main part of his treatment.

Our confidence in endotherapy as a treatment for the removal of malignant lesions of the oral cavity, and our belief that better results will be achieved in the treatment of all neoplasms when endotherapy is employed *in the beginning* in all those cases to which it is applicable, are based upon the record made by the method over a period of five years, a record made upon cases referred for treatment in many instances after surgery and physical measures—one or both—had failed. It is after careful consideration of the admirable results achieved by proper endothermic procedure that we affirm that endotherapy should be given the preference in treating malignant lesions of the oral cavity. We enumerate the following explicit reasons for our belief:

1. By endotherapy the extent of the destructive process is definitely under the control of the operator.
2. The effect of endotherapy's destruction is immediate. The operator is not obliged to wait many weeks to determine just what has been accomplished by the forces he has set in motion.
3. Treatment by endotherapy is followed by immediate cessation of pain. Sensory nerves are severed and capped.
4. This capping of nerves tends to eliminate surgical shock.
5. There is no post-operative reaction, and the patient is able to return immediately to normal diet.
6. There is no hemorrhage. The operator is spared the need of working in a field obscured by blood.
7. No other method offers endotherapy's protection against the danger of recurrence and the threat of metastasis. The technic which isolates the malignancy, before its removal as dead tissue, by a path of protective destruction drawn in healthy tissue, and which thereby seals lymphatics to and from the affected part, is peculiar to endotherapy.
8. Endotherapy can be used in repeated treatments without prejudice to the patient. This is because lesion treated is destroyed and removed in a single operation without injury to surrounding tissue. The appearance of subsequent nodule or induration can be met with destruction and removal on precisely the same terms as the first lesion, if endotherapy is the remedial agent.

For any and for all of these reasons endotherapy should be given the precedence in the treatment of cases of malignancy of the buccal surfaces.

In directing attention to a new method, or to a modification of old methods, we are moved to quote what McArthur⁶ so effectively said at the meeting of the American Medical Association in St. Louis in May, 1922. Urging upon his colleagues the need, in certain instances, for operative procedures at variance with established surgical teaching, Doctor McArthur said: "Otherwise surgical judgment is banished and surgery becomes a set of formulas; the surgeon disappears and there remains only the operator."

* McArthur, Lewis L.: Atypical Operations on the Jaws and Mouth for Malignant Growths. J. A. M. A., October 28, 1922.

TECHNIC OF USE OF REMOVABLE RADON SEEDS IN CARCINOMA OF THE TONGUE

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THE high incidence of cancer of the tongue, its rapid development and likelihood of early glandular metastasis, and great disfigurement and functional impairment which often attend its surgical extirpation, and above all

the tremendous mortality associated with it, cause it to be one of the most dreaded of malignant neoplasms. In view of this fact it is rather surprising to find very few recent statistics concerning its incidence or other phases of the subject upon which it would be desirable to have exact information. Although recent literature offers many titles, a search for such figures usually leads us—often through a series of quotations and re-quotations—back to the work of Jessett, published in 1886. This English observer studied the whole subject of buccal cancer very exhaustively, and by comparison of his own cases at the London Cancer

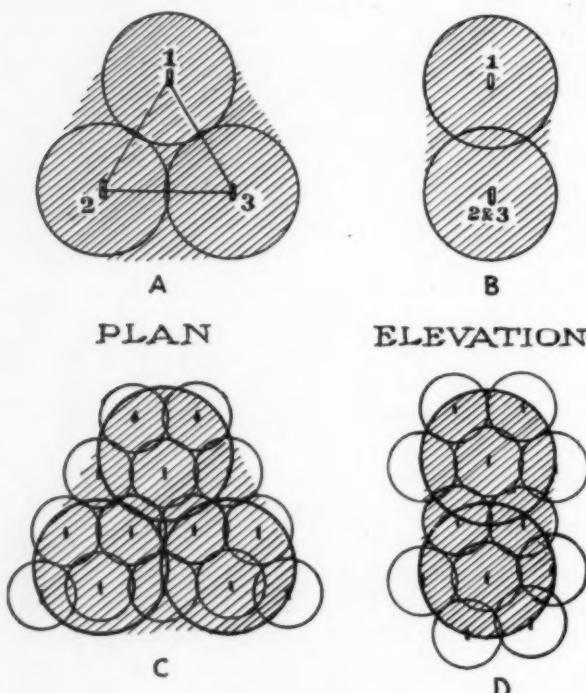


FIG. 1.—A shows the plane of the triangle with a seed implanted at each angle (the shaded area indicates the approximate extent of active radiation); B shows horizontal axis of triangular plane; Seed 1 appears as in A, but Seeds 2 and 3 are shown super-imposed (shaded portion shows approximate thickness of radiation); in C and D are demonstrated the number of unfiltered seeds required to radiate an equal amount of tissue; 30 to 40 bare seeds would be necessary to do the work accomplished by three radon platinum seeds.

Hospital with those of other English and some German surgeons, placed the incidence of cancer of the tongue at 8 per cent. of all malignant neoplasms, being exceeded in frequency only by breast cancer—31.3 per cent., and uterine cancer—12.3 per cent. Though these percentages may have altered slightly during the forty years since Jessett wrote, it is probable that they are not far from the actual figures, and are sufficiently formidable to emphasize the necessity of considering any and every possible means of successfully combating this grave and prevalent disease.

RADON SEEDS IN CARCINOMA OF THE TONGUE



FIG. 2a.—Three-dimensional palpation of the tongue. Antero-posterior palpation.

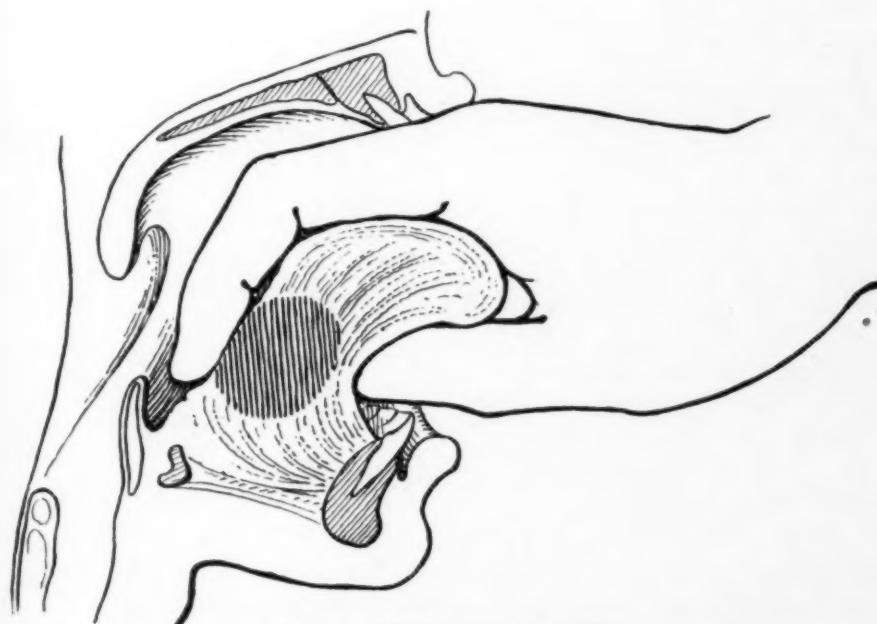


FIG. 2b.—Palpating vertical dimension.

The age at which tongue cancer is likely to appear is the same as that of similar lesions elsewhere, most frequently in the fifth and sixth decade of life, though the incidence even past the age of seventy is still quite high. Unlike many other malignant lesions, however, the factors of etiologic importance seem more fully established, for the general conception that constant irritation or continued slight trauma influences the location of malignant growths finds strong confirmatory evidence in all buccal neoplasms. Cancer of the tongue is seven times as frequent in men as in women, but in either sex there is practically without exception a history either of the excessive use of tobacco or the long-continued presence of diseased and broken teeth in continual contact with the lingual

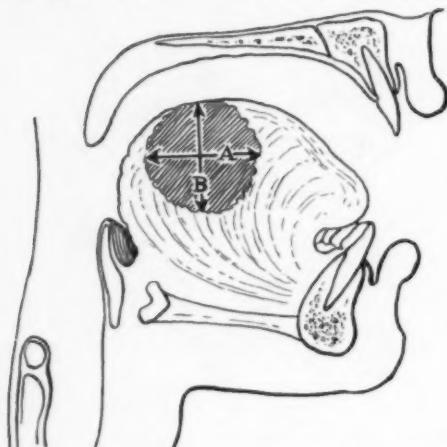


FIG. 2c.—Schematic representation of direction of palpation shown in a and b.

mucous membrane. As Bloodgood has tersely put it: "Tobacco, rough and dirty teeth and improperly fitting plates predominate as causes of cancer of the tongue." Of this surgeon's 160 cases, only two did not use tobacco, as even "in the few cases of cancer of the tongue in women, the patients have used tobacco, usually in the form of snuff by the mouth." The two men who did not use tobacco both had a long history of bad teeth, with injury to the tongue from contact with a broken tooth. All writers seem to agree that chemical irritation contributed by the tobacco itself, or the necrotic products of diseased teeth are quite as dangerous as the mechanical effects from smoking burns, or wounds from ill-fitting dentures or broken teeth.

As regards the importance of syphilis as a predisposing factor, there appears to be considerable difference of opinion. But the coincidence of syphilitic buccal lesions with subsequent malignancy in the same area, is too frequent to permit of its being disregarded.



FIG. 3a.—Palpation of lateral dimension.

RADON SEEDS IN CARCINOMA OF THE TONGUE

Taussig's caution that an untreated syphilitic lesion of the tongue should always be watched with suspicion, especially when subjected to the trauma of the excessive use of tobacco or of a rough tooth, and his assertion that the recognition and proper treatment of syphilis of the mouth and proper dentistry will undoubtedly lessen the frequency of cancer of the tongue, are deserving of thoughtful consideration by everyone interested in reducing the incidence of this particular malignant lesion.

The mortality in untreated cases of tongue cancer is very high, at least three-quarters of those thus neglected dying within six months.

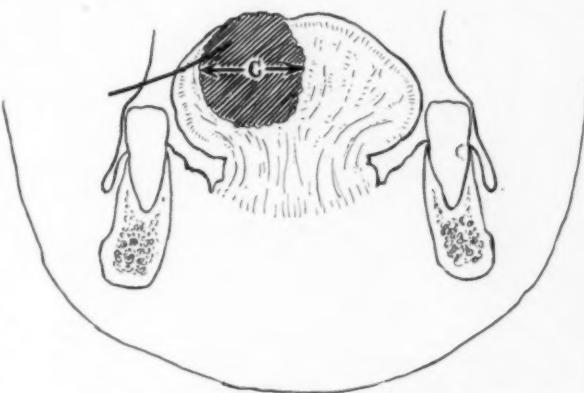


FIG. 3b.—Schematic representation of results obtained by a.

But unfortunately, treatment, while it reduces the immediate mortality somewhat and has lowered the other distressing figures considerably, on the whole has never proved in any degree satisfactory, so that whatever may be put forward offering a chance of better results, will be widely

welcomed. Up to a few years ago, surgery was the only method of cure which could in any way claim to be successful, although this is actually applicable to but a small proportion of lingual malignancies. When the discoveries of Röntgen and the Curies added radiotherapy to the physician's armamentarium, high hopes were raised that a means had at last been found of combating cancer of the tongue wherever located, but



FIG. 4a.—Implantation of a lateral border lesion. Counter-pressure is being made with the thumb as the seeds are placed.

the history of the past twenty years shows that these hopes—though by no means ill-founded—have been realized only in very small part. Yet the most far-sighted of radium therapists saw that while surgery had attained its maximum efficiency in this particular line of endeavor, the possibilities of

radiation were but just beginning to be appreciated, so that the constant widening of our knowledge of its powers, together with the continually increasing exactness of the technic of its application, gave every promise of much greater usefulness yet to come

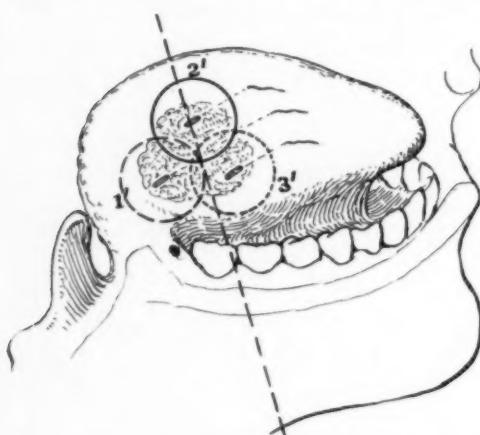


FIG. 4b.—Distribution of implanted seeds in relation to normal tissue; the lateral aspect is schematically presented with Seeds 1, 2 and 3 disposed in the antero-posterior plane; the thread end is seen protruding from the implanter's point of entrance as shown in a; irregularly shaded area indicates malignant tissue.

surgery." When seen early, before extensive infiltration of the lingual tissue has occurred, or glandular metastasis has taken place, surgical excision has often given excellent permanent results. Unfortunately, few of these neoplasms are seen early, and many of them are located elsewhere than upon the end of the tongue; for this reason the record of surgical cure is not a brilliant one, and no one realizes more than the experienced surgeon, how little his skill will avail in the majority of cases.

Because of the terrible mutilation produced by most of the surgical interventions and high primary mortality which attends them, electric coagulation and the application of X-rays and radium were advocated as treatments for tongue cancer very early in the history of these different therapeutic aids. The results of these physical agents appear on the whole to be better than those of surgery, but there is a strong feeling on every hand that a vast improvement over anything that has been accomplished up to the present is highly desirable. One of the pioneers in radium therapy of tongue cancer was the Memorial Hos-



FIG. 4c.—Circles 1', 2' and 3' show extent of radiation from Seeds 1, 2 and 3. The plane of frontal section is indicated by the straight broken line.

RADON SEEDS IN CARCINOMA OF THE TONGUE

pital, New York, but their first report made in 1916, did not offer great encouragement. Up to that time they had employed only external or surface applications and had found that in lesions over one centimeter in diameter, this method offered little chance of permanent cure. Shortly after this they adopted the plan of using bare tubes of radium emanation, which were buried in the growth, and following the employment of this technic their results steadily improved. Tubes not over one millicurie in strength were buried uniformly throughout the growth by means of fine trocar needles, the total dosage amounting to from 6 to 15 mc. left *in situ* so that each millicurie gave approxi-

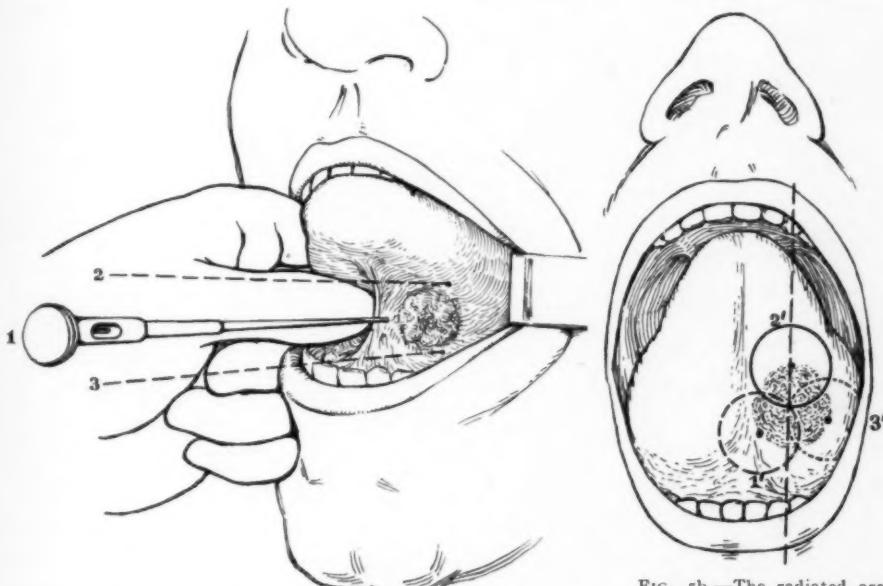


FIG. 5a.—Method of implanting lesion at root of tongue.

FIG. 5b.—The radiated area viewed from in front, the tongue being upraised.

mately 132 hours of continuous radiation. The very prolonged beta and gamma radiation which they obtained by the use of unfiltered glass containers, they regarded as superior to the shorter exposure of mainly gamma rays where metal containers with large amounts of the element were placed in the growth for periods of only a few hours. In 1923, Quick reported 128 cases treated by this method. Metastasis to the cervical glands was treated by external radiation where the neck was free from palpable involvement; when involved a conservative dissection was first carried out, and very weak tubes of radium emanation thereafter buried throughout the wound.

In France the most brilliant and satisfactory work in radium therapy of tongue cancer has been done by Claude Regaud, director of the Paris Radium Institute, who presented his results before the Strasbourg Radiologic Congress in 1923, and again last July, at London, at the meeting of the First International Congress of Radiology.

In obtaining his results—which were hailed by his hearers at the London

Congress as the best ever given for the cure of tongue cancer, far exceeding any ever claimed for surgery—Regaud was governed by the following rules:

Use only gamma rays, thus avoiding all necrotic action.

Employ continuous radiation of long duration, the intensity of the dose being gradually reduced during the period of application.

Depend for success upon a single treatment, for repeated dosage may render the neoplasm radioresistant.

Distribute many radioactive centres of low intensity throughout the malignant lesion and in the apparently healthy tissue surrounding it, using care to distribute the entire dose as evenly as possible.

When he failed of success he found that the total dosage had been insufficient; the radioactive centres had been unevenly distributed so that there was too much radiation in one place and not enough in others; the applicators were defective, either in the filtration which they provided or the form of radium which they contained; or necrosis had taken place.

To avoid these causes of failure he made use of platinum needles, 0.5 mm. thick, which he regarded as superior to bare tubes or needles with insufficient filtration. He emphasized the advantages which radium emanation

FIG. 5c.—Shows plane of antero-posterior section (indicated by broken line on 4b). Circle 2' coincides with the plane of section, Circle 1' being below and Circle 3' above.

offers over radium salts for use in these platinum needles. The size of the malignant growth was estimated with the greatest exactitude, and the needles implanted throughout at carefully spaced intervals. The methods of measurement are not described. In the discussion of this paper before the London Congress, Regaud added that the needle method was only efficacious "when access to the neoplastic region is easy," a condition obtaining only in cancers on the anterior dorsum or below the tongue. He regarded the 0.2 mm. thick gold tubes which had just been put forward by Quick and Failla of the Memorial Hospital as an important advance step, but still felt that the filtration thus provided was inadequate. Nothing short of 0.4 mm. of platinum would be absolutely protective, and this made too large a foreign body to be safely left in the tissues. For this reason he favored needles, as they could be withdrawn at pleasure.

The factors still to be sought in order to provide a wholly adequate radium technic, as listed by the man acknowledged by the assembled radiologists of the world as the most successful therapist of cancer of the tongue, I believe



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to be all included in that which I am about to describe. These factors are: Adequate platinum filtration, doing away with all danger of necrosis; small size, so that the implantation of the applicator induces a minimum of trauma; possibility of accurate measurement even of the most inaccessible lesion, insuring even distribution of radiation; complete intra-neoplastic insertion, so

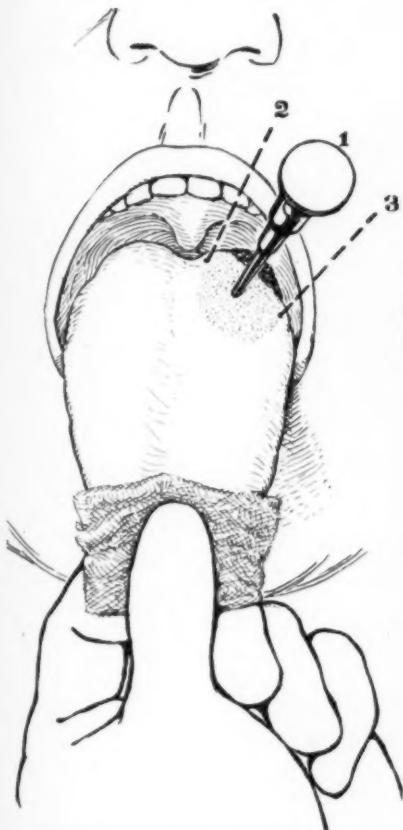


FIG. 6a.—Showing implantation in a low lesion, far back at the base of the tongue in which successful counter-pressure may be impossible. Stippled area represents the invisible portion of the growth which should be visualized by the operator through careful palpation. A small margin of the growth is to be seen on the left upper edge of the tongue.

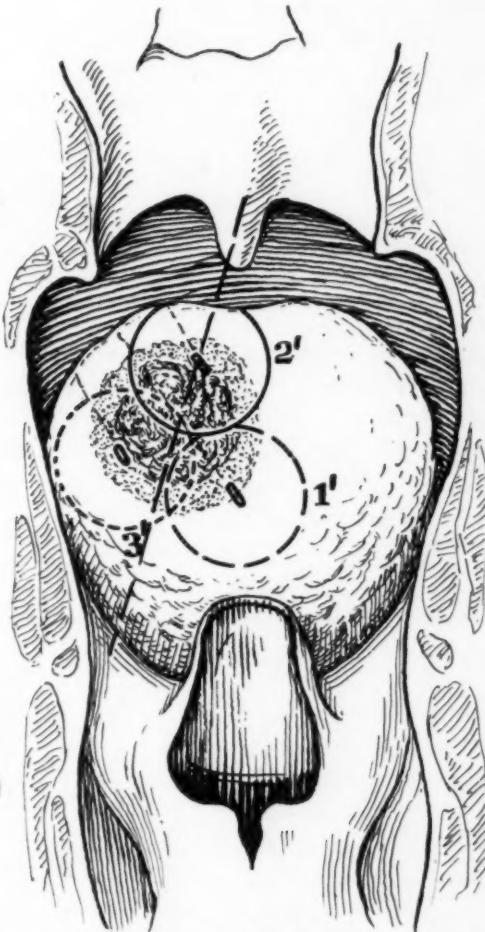


FIG. 6b.—Shows disposition of seeds on the posterior aspect of the tongue. The broken line passing through Circle 2' represents the plane shown in 6c.

that there is no chance of dislocation nor expulsion of the applicator before a sufficient exposure has been made; and finally, easy and complete removal whenever it is desired to conclude the treatment.

Instead of the needles advocated by Regaud, I employ a removable platinum radon "seed." I have found that a filter as thick as 0.4 mm. of platinum is not necessary, because, according to the experiments of Lacassagne, when using filtration of 0.3 mm. platinum, during a twelve-day exposure, necrosis begins only when the radioactive centre has a value of 7 millicuries. By

limiting the amount of radium emanation employed in a single centre to 2.5 millicuries, no evidence of necrosis has ever followed any of my implantations.

The "seed" is so minute that its implantation causes little or no trauma,

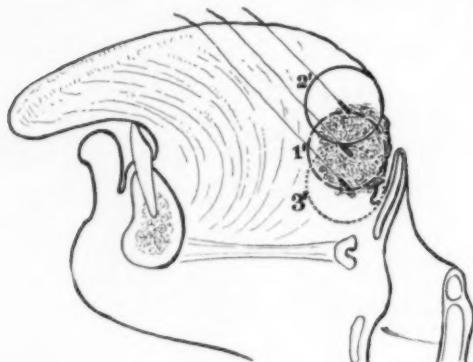


FIG. 6c.

its dimensions being practically the same as those of the bare tube previously used; while the fact that each "seed" can safely produce an intensity of from five to ten times that possible by the old bare-tube method greatly reduces the number of seeds required to insure complete radiation of a given neoplasm. The proper distribution of this radiation is attained through a precise preliminary estimation of the size of the lesion, and the exact placing of each seed, which can be accomplished no matter how surgically inaccessible the lesion may be. The seed may be of any length desired, being radioactive throughout, so that its dimensions can be adapted to the depth or breadth of the area to be treated, thereby reducing the total number of seeds required to insure complete radiation. The seed is completely buried in the malignant tissue, thus sharing all the bare tube's advantages over the needle as regards retention of position and non-interference with function of the surrounding parts. Finally, an attached thread makes it readily removable when sufficient radiation has been given. The thread ends can be cut off so short that their presence causes the patient no inconvenience, while if the implantation is done under proper aseptic precautions there is no more danger of infection being conveyed by the thread than there is of sutures becoming infected in internal surgery. The "stitch-abscess" is everywhere regarded as the hallmark of the inefficient surgeon, and failure to observe every aseptic precaution is exactly as reprehensible in the radiologist. As soon as the seed is withdrawn the channel kept open by the thread immediately closes, and has never given us any trouble thereafter.

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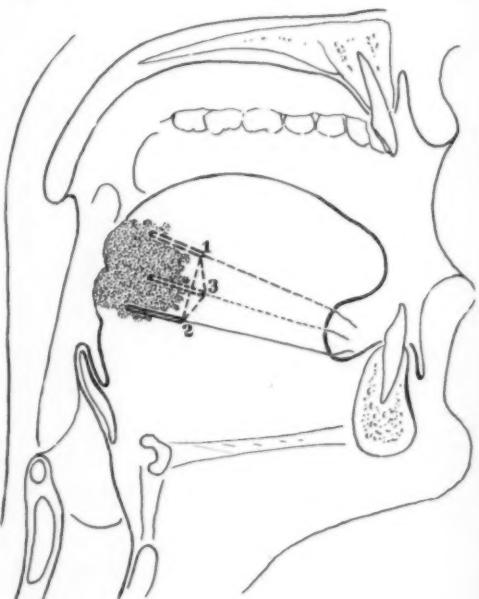


FIG. 7.—Shows implantation when long centres of radioactivity are used. The completely closed platinum radon seed does not offer any chance of necrosis such as is afforded by the needle open at both ends.

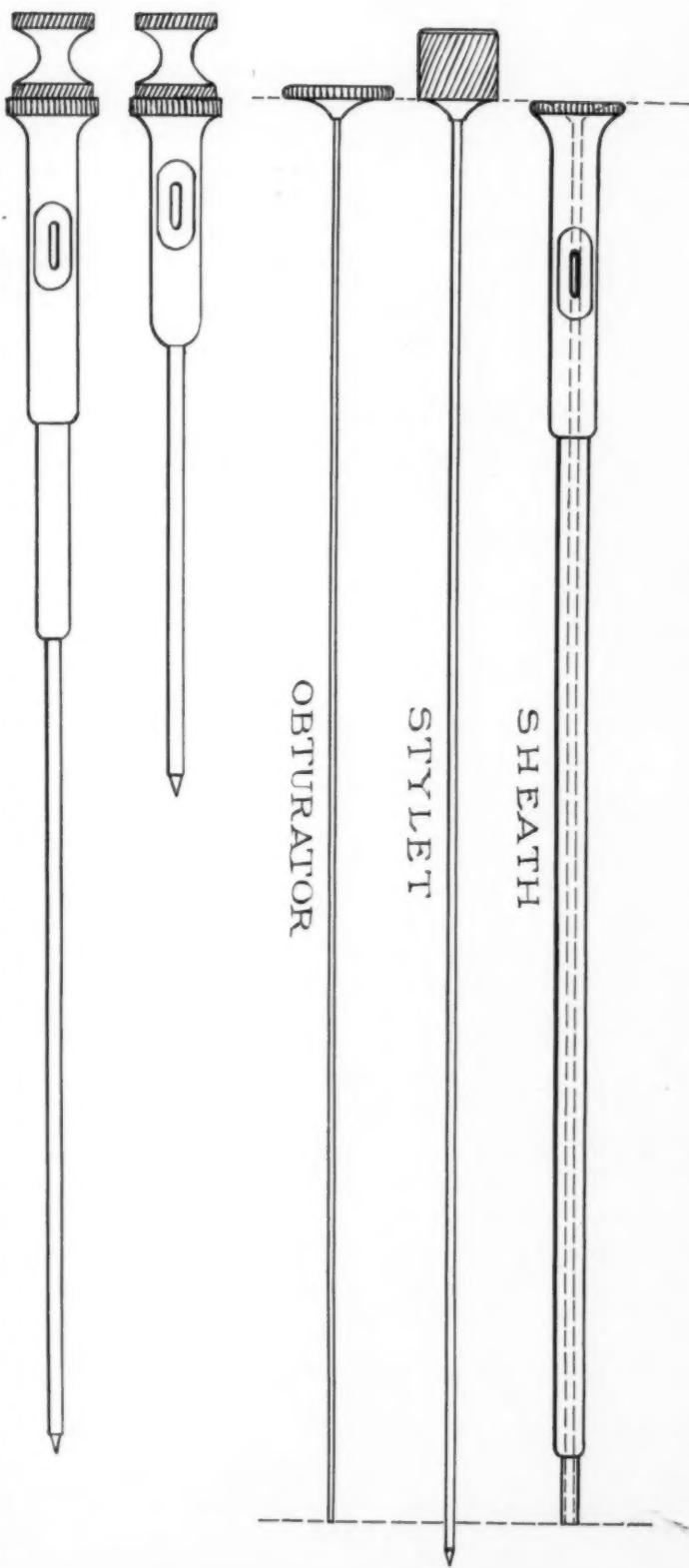


FIG. 8a.—Implanter, showing sheath, sharp-pointed stylet especially tempered to sufficient fineness to induce very little trauma to the tissues, and to leave room in the lumen of the sheath for the passage of the thread attached to the removable seed.

Technic.—The technic depends for its success upon proper distribution of the radiation, which can only be attained by exact measurement of the lesion. The operator must visualize one or more equilateral triangles at the angles of

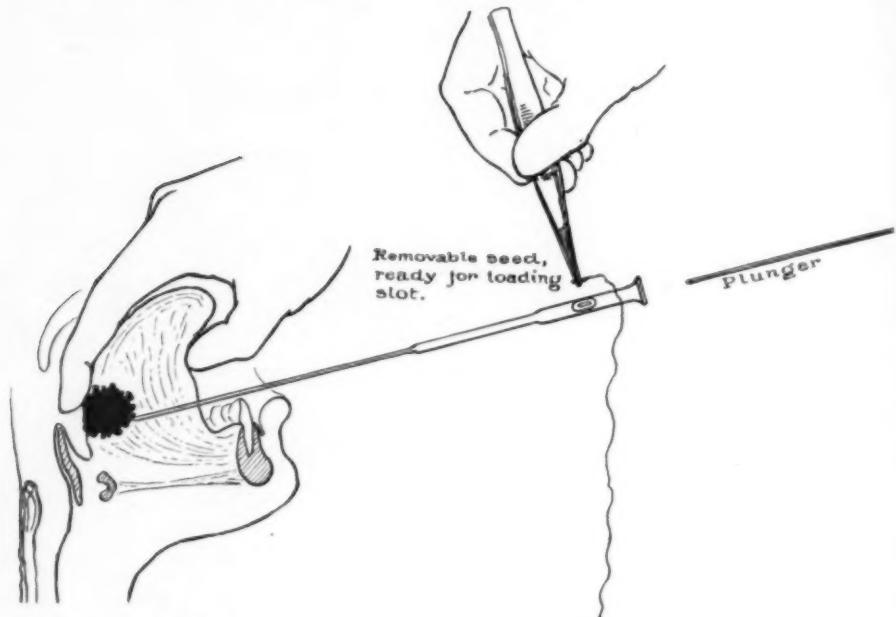


FIG. 8b.—Implanter in position for placing seed. Plunger held in readiness to drive seed home.

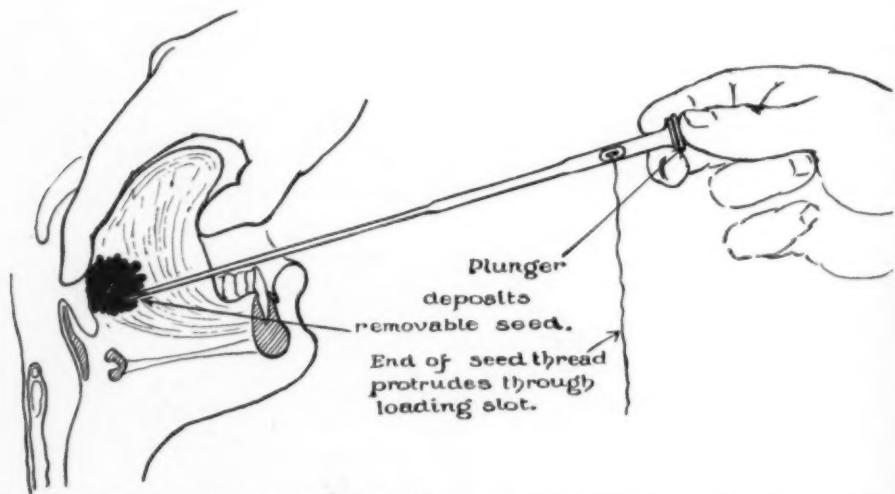


FIG. 8c.—Operator's hand pushes seed into its place by means of plunger; seed-thread drawn into lumen of implanter as seed is pushed down.

which the seeds are implanted. The length of each side of the triangle must be twice the length of the radius of radiation from the seed; that is, if the radius of radiation be 1 cm., the sides of the triangle should be 2 cm. long.

RADON SEEDS IN CARCINOMA OF THE TONGUE

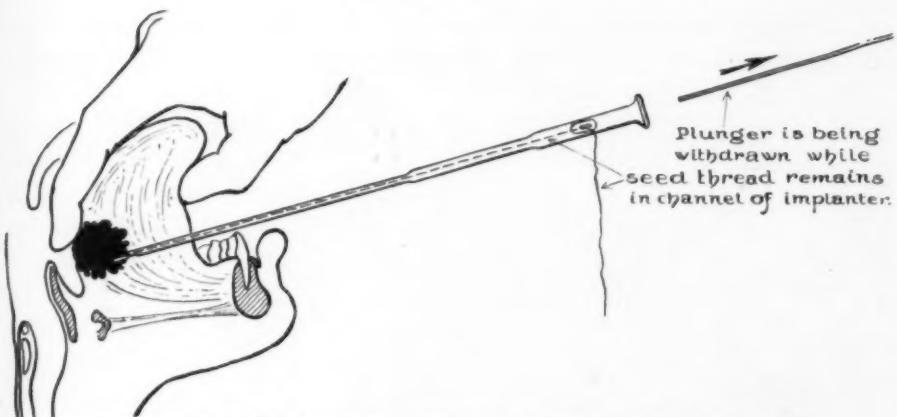


FIG. 8d.—Seed in place; plunger being withdrawn, leaving thread in lumen of sheath.

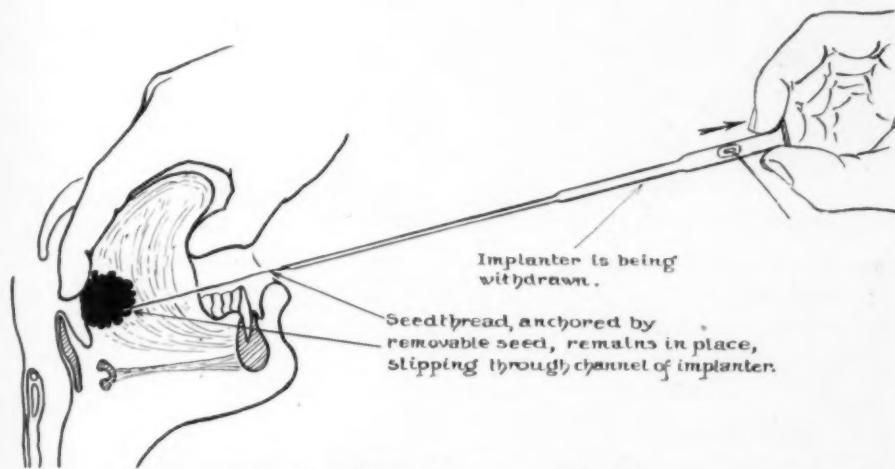


FIG. 8e.—Implanter withdrawn in direction of its long axis, so as not to displace seed by traction.

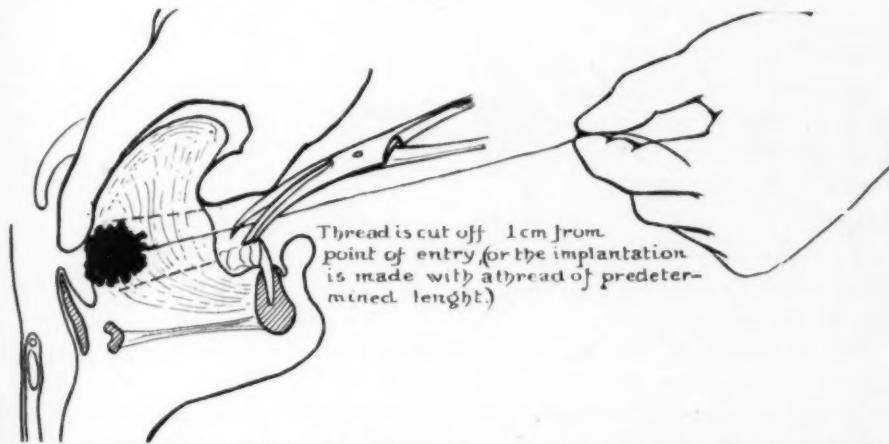


FIG. 8f.—Thread is cut off; dotted lines extending from root of tongue toward malignant area indicate course of other two seeds, each thread being cut off on withdrawal of implantation, taking care not to displace by traction.

The area of tissue irradiated about the seed is represented on the diagrams as a circle upon a plane surface, but the operator must consider it in his mind as a sphere or globe with the seed in the exact centre.

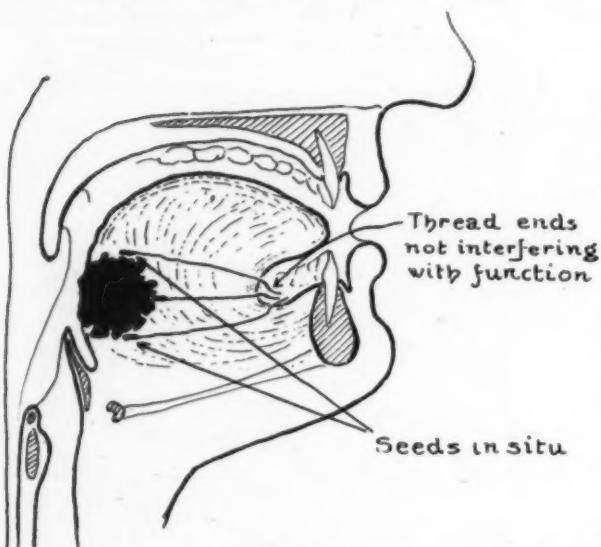


FIG. 8g.—Seeds *in situ*; threads cut off; no interference with function.

seeds which would be required to irradiate an equal amount of tissue, for as each bare seed can irradiate but 1 cm., it would require from thirty to forty unfiltered seeds to furnish radiation equivalent to that supplied by three platinum radon seeds.

Figures 2 and 3 show three-dimensional palpation in cancer of the tongue. In Fig. 2 (c) Arrow A indicates the direction of antero-posterior measurement, and Arrow B vertical dimension; in Fig. 3 (b) Arrow C shows lateral dimension.

In Fig. 4 (a) is shown implantation of a lateral border lesion. Counter-pressure is being made with the thumb as the seed is placed. Distribution of implanted seeds in relation to neoplastic area is shown in (b) and normal tissue in (c). In (b) the lateral aspect is schematically presented with Seeds 1, 2 and 3 disposed in the antero-posterior

In Fig. 1 (a) is shown the plane of the triangle with a seed implanted at each angle (the shaded area indicates the approximate extent of active radiation); (b) shows horizontal axis of the triangular plane; here, the position of Seed 1 appears as in (a), but Seeds 2 and 3 are shown superimposed (shaded portion indicates approximate thickness of radiation). In (c) and (d) are shown the number of unfiltered

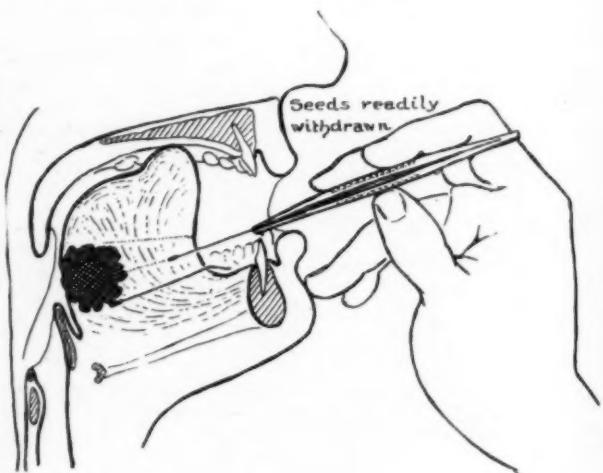


FIG. 8h.—Withdrawal of seeds when desired period of radiation is completed.

RADON SEEDS IN CARCINOMA OF THE TONGUE

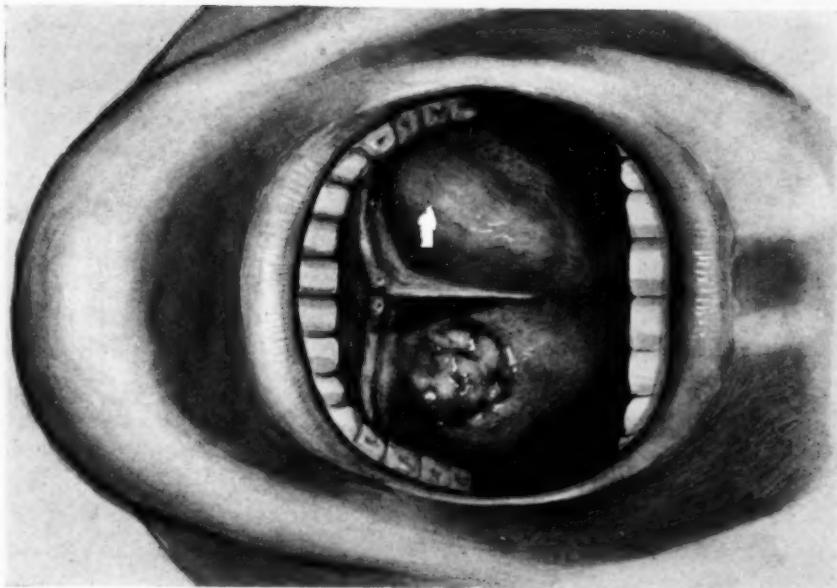


FIG. 9.—Carcinoma of the under-surface of the tongue. Sub-dorsal malignancy may be located beneath the dorsum, or upon the floor of the mouth.

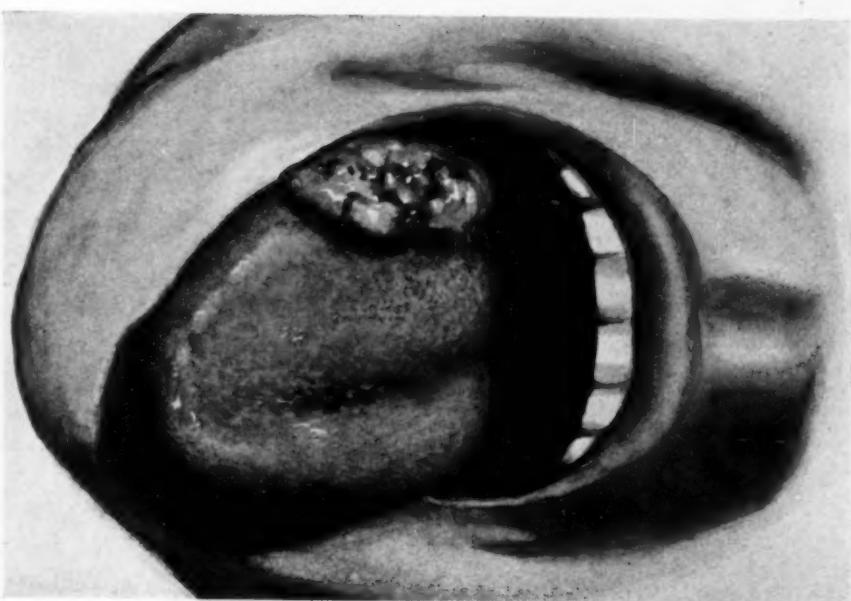


FIG. 10.—Carcinoma of the edge of the tongue. The lesion here illustrated is located somewhat farther back than those which are usually regarded as amenable to surgery.

plane. The thread end is protruding from the point of entry of the implanter as shown in (a); irregularly shaded area indicates malignant tissue. Circles 1', 2' and 3' show extent of radiation radius from Seeds 1, 2 and 3. The plane of frontal section is indicated by the straight broken line.

Figure 5 indicates the method of implanting a lesion at the root of the tongue; (b) is the radiated area viewed from the front, the tongue being upraised. The plane of antero-posterior section [indicated by broken line on

4 (b)] is shown at (c). Circle 2' coincides with the plane of section, Circle 1' being below and Circle 3' above.

Figure 6 shows implantation in a low lesion far back at the base of the tongue, in which successful counter-pressure may be impossible; this is the type of lesion which Regaud finds unsatisfactory when treated by X-ray, but for which his radium technic provides no certain means of application. The stippled area in (a) represents the invisible portion of the growth which should be visualized by the operator through careful palpation. A small margin of the growth may be seen on the left upper edge of the tongue; (b) shows disposition of seeds on the



FIG. 11.—Carcinoma of the "root" of the tongue. Here the malignant area is situated far back upon the posterior dorsal surface, a location where therapy of any sort is regarded as peculiarly difficult.

posterior aspect of the tongue. The broken line passing through Circle 2' represents the plane shown in (c).

Figure 7 shows implantation when it is considered desirable to apply longer centres of radioactivity as recommended by Regaud. This type of applicator has the advantage of being entirely closed, making filtration absolutely complete, whereas the needles are open at both ends, thus never providing absolute complete filtration.

In Figure 8 are set forth the various steps in the technic of implantation, illustrating the facility and exactness with which the radioactive centres can

RADON SEEDS IN CARCINOMA OF THE TONGUE

be placed. Attention is especially directed to the ease with which the seeds are removed after the desired period of radiation has elapsed.

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THE EXPERIMENTAL PRODUCTION OF DUODENAL ULCER BY EXCLUSION OF BILE FROM THE INTESTINE*

BY ROBERT KAPSINOW, M.D.

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THE etiology of chronic ulcer of the duodenum in man has long been a subject of much discussion. Anatomical and physiological studies have been carried on in detail and upon these findings many theories have been propounded. That these theories yet remain but hypotheses is suggestive of a paucity of conclusive evidence as to the etiological agent or agents.

In animals, and in particular in the herbivorous species, it has long been recognized that acute ulceration occurs under a variety of conditions, such as extreme malnutrition, profound intoxication and as a terminal event in many infectious processes. Chronic or even subacute ulcers, however, are not found with any degree of frequency and this is particularly true in dogs (Ivy¹). This animal is then a good subject for experimentation and much work has been done on the production of acute ulcers by utilizing dogs already diseased, as with distemper or mange or those in whom a generally diseased condition has been induced. In such animals trauma or the implantation of a virulent organism may produce a subacute or chronic ulceration (Rosenow²), (Ivy,^{1, 3, 4}), but this sequence of events rarely if ever corresponds to the development of the disease as seen in the clinic. In addition these manœuvres introduce such a multiplicity of etiological agents that one may be still in doubt as to the precise cause of the ulceration.

More definite evidence has been submitted by Mann and Williamson⁵ who have been able to produce ulceration of that part of the intestine which is adjacent to the pylorus in a large proportion of their experiments. These involved the transplantation or excision of the duodenum, or the transplantation of the bile and pancreatic ducts, with or without the duodenum, into a portion of the intestine far away from the stomach. They conclude that when the secretions, normally present in the duodenum, are transferred to a point elsewhere in the intestine, that portion of the gut left exposed to the action of the gastric contents undergoes ulceration of a chronic type.

In a series of experiments concerning the functions of the bile a method, described in detail elsewhere,⁷ was devised for the exclusion of the bile from the intestine, in such a manner that infection of the ducts might be avoided and likewise any possibility of ingestion of even small portions of the bile. This consists essentially of an implantation of the fundus of the gall-bladder transcutaneously into the pelvis of the right kidney, thus establishing an anastomosis—a cholecysto-nephrostomy. At a later date, when healing

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is complete, the flow of bile is entirely diverted into the urinary tract by ligation and division of the common duct.

It is obvious that this procedure can be carried out with no trauma to the intestine. The first stage is followed by the appearance of bile in the urine, but there is no loss of weight or impairment of the animal's health. Following the second stage—the relatively minor operation of ligation of the common duct—the picture changes. With the complete exclusion of bile from the intestine the animal loses weight, soon refuses the greater part of his food, the stools become tarry, and if he is sacrificed or autopsied after an interval of two weeks or longer following the operation, one finds,

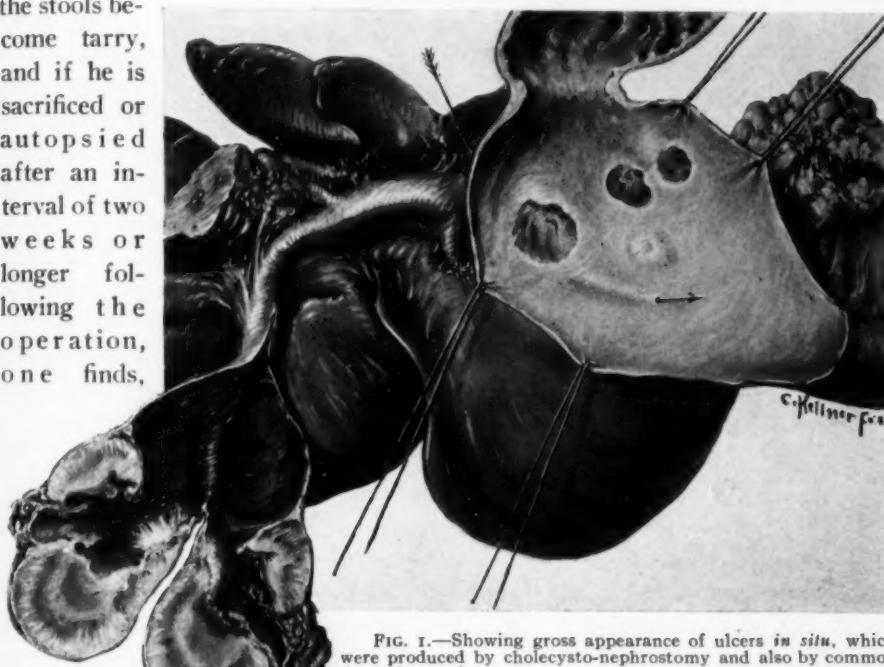


FIG. 1.—Showing gross appearance of ulcers *in situ*, which were produced by cholecysto-nephrostomy and also by common duct obstruction.

with great frequency described by Mann and

Williamson. Of 43 animals, 17 developed typical duodenal ulcer.

ulcers of the duodenum of the type that are

usually in the vicinity of the ampulla of Vater. They bear no relationship to the mesenteric border of the intestine. In size they vary from a minute ulceration to those measuring $1\frac{1}{2}$ to 2 cm. in diameter. The defect has a punched-out appearance, the edges are overhanging and frequently the ulceration extends through to the serosa. In two instances there have been definite perforations. Microscopically, the appearance is that of the subacute or chronic peptic ulcer in man.

The formation of duodenal ulcers following gastro-enterostomy may represent an analogous procedure by which intestinal mucosa insufficiently protected by alkaline juices of the duodenum is exposed to the gastric contents, and Dodd and Linn⁶ in the course of the experimental formation of a

pouch from the antrum pylori have encountered ulcers in the short-circuited duodenum.

Such experiments have two factors which are open to criticism. Firstly, the animals are usually suffering from a considerable degree of malnutrition as a result of the extensive and deforming procedures carried out. Secondly, the intestine is subjected to direct and extensive trauma and the possibility of interference with its blood supply is always present.

If one could produce ulcer in the duodenum by an operative procedure not involving in any degree the intestinal wall and carried out upon animals

whose vitality was normal, then the evidence as to the importance or unimportance of these secretions might be fairly conclusive. There is, of course, no method of deflecting the secretion of the duodenum itself, without subjecting the intestine to operative trauma. The pancreatic duct, as is well known from the experiments of Minkowski and

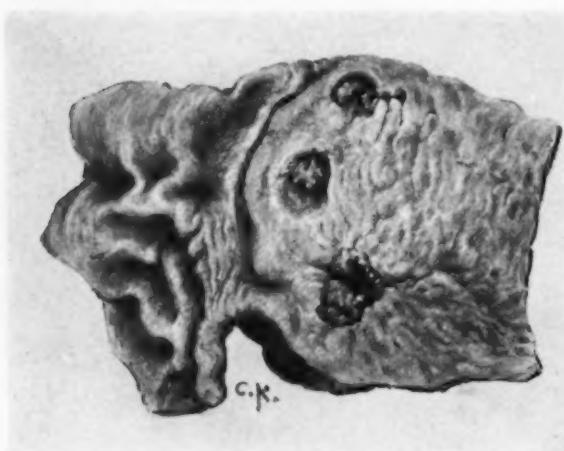


FIG. 2.—Typical ulcers produced.

many others, may be ligated with no damage to the intestine, and no appreciable impairment of the animal's health. This procedure, however, does not produce chronic ulcer of the duodenum. Ligature of the common duct with the resulting obstructive jaundice leads rapidly to so severe an intoxication of the animal that any positive result which might be obtained would not be of any great significance. In the experimental biliary fistula of the customary type, that is, with a sinus leading from the skin to the gall-bladder and with the common duct ligated, such ulcers do occur (Whipple). The probability of infection of such a sinus and of an ascending infection of the hepatic ducts makes positive findings inconclusive, while the absence of ulceration might hypothetically at least be explained by the dog's ingestion of bile by licking the wound.

It would seem, then, that such ulceration can be produced without trauma to the intestinal wall as a contributing factor and that they may be brought about in dogs not previously diseased. Whether these lesions precede or follow the nutritional disturbances incidental to the exclusion of the bile is not decided. It is at the present time unwise to enter into any hypothetical discussion as to the way in which the exclusion of the bile acts. It is well to keep in mind that the bile has other functions beside that of an ant-acid and

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that the gastric secretion is not composed of hydrochloric acid alone. Further experimentation will be necessary in order to determine the details of the processes leading to the formation of these ulcers.

SUMMARY

Exclusion of bile from the intestine by a cholecysto-nephrostomy with

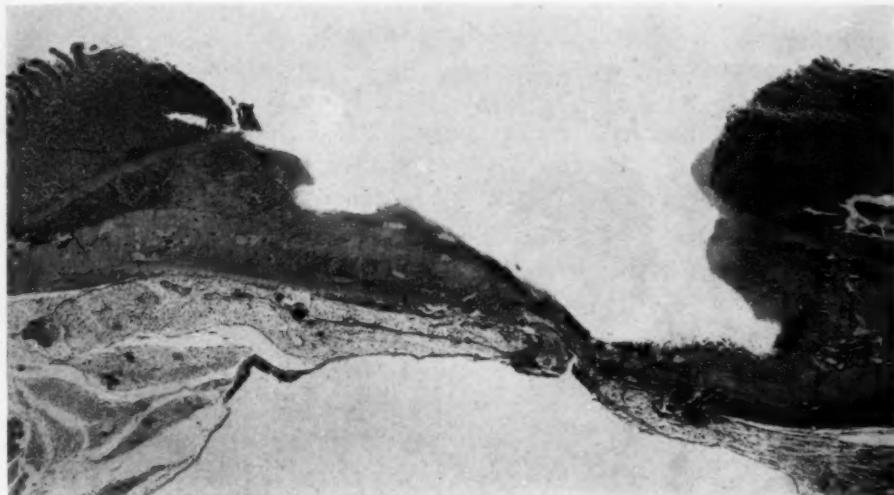


FIG. 3.—Cross-section of chronic ulcers demonstrating the punched-out overhanging edges.

ligation of the common duct, frequently, leads to the formation of subacute and chronic ulcers in the duodenum.

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AIDS TO CHOLECYSTECTOMY*

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VARIOUS steps in the operation of cholecystectomy will be described which have given a technic which is a pleasure to the operator and a comfort to the patient. No claim for originality is made.

This success has been attained by paying particular attention to the following:

1. A good exposure by an incision which also allows of direct drainage if necessary, and minimizes the dangers of subsequent hernia.



FIG. 1.—Subserous excision of gall-bladder. Incision through peritoneal coat.

Incision.—Like all other operations, easy extirpation of the gall-bladder presupposes a good exposure. A good incision must allow of a good view of the triangle formed by the junction of the three ducts—cystic, hepatic, and common.

An incision most readily allowing of the pulling down and eversion of the liver with access to its under surface is desirable. In a thin patient with lax abdominal walls and general "floppiness" of the abdominal viscera, almost any kind of incision will do. With the obese—deep wound, and a liver that will not budge—we have a problem.

* Read before the New York Surgical Society, February 24, 1926.

AIDS TO CHOLECYSTECTOMY

Exposure of the liver may be obtained by several incisions: 1. Straight, anywhere from the outer border of the rectus to the midline. Modifying the straight incision into the form of a bayonet or letter "Z." 2. Right-angled, such as the Perthes. 3. Oblique, parallel to costal arch, generally known as Courvoisier.

1. The *straight* incision generally suffices if it is long enough; but has the disadvantage if big enough, of giving rise to many post-operative herniae (even with primary union) from destruction of the nerve supply. The straight incision, if bordering on the midline, does not allow of the shortest path for a drain.

2. *Right-angled*. Perfectly good incision for the bad cases, if it is known that the procedure is to be complicated. Its disadvantages are: time consuming, cuts across the rectus, and disastrous if primary union is not obtained.

3. The *Courvoisier* incision allows of: (1) Better delivery of the liver. (2) Direct drainage at any part of it that may be necessary. (3) Runs parallel to the nerve fibres and both in theory and practice does not give rise to post-operative hernia.

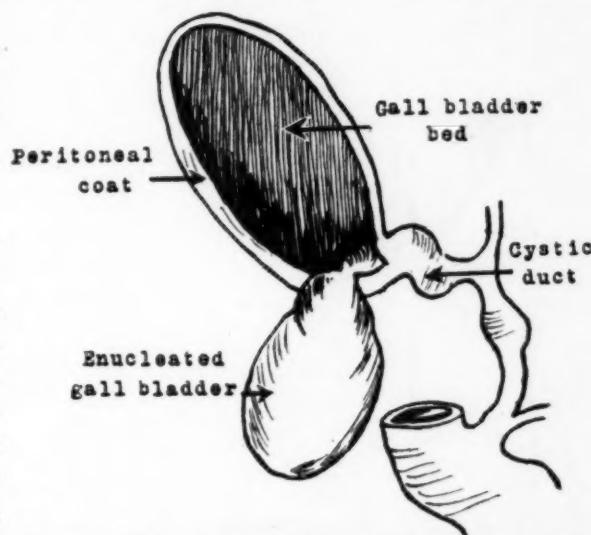


FIG. 2.—Gall-bladder entirely freed from its peritoneal coat. Hanging by its sole attachment, the cystic duct.

The disadvantages, practical and theoretical, are: (1) A little bloodier. (2) A little harder to close. (3) Does not lend itself so well to supplementary operations, such as appendectomy.

This is the incision I used in my earlier work and to which I have returned as more nearly the ideal. I use it, however, only when the diagnosis seems quite certain.

If the gall-bladder is not friable it can be used to pull up the liver, giving a good exposure to the ducts. The last step in the operation should be the removal of the gall-bladder and all the deeper work—haemostasis and suturing—should be done while the gall-bladder remains attached to the liver.

Hæmostasis.—In the beautifully illustrated works on operative surgery, the cystic artery is an attractive vermillion colored structure, standing out prominently to the north of the cystic duct—a direct invitation to a ligature. In practice, "there ain't no such animile." There are some indefinite strands of tissue at the bottom of a deep dark hole. These strands form an obstacle

to the lifting up of the gall-bladder after the cystic duct has been divided. One of these strands is the cystic artery.

Moral.—Divide any and all of these strands only after a double ligature and on the central side, along the ligature, also place a clamp. Then cut between the ligatures and then tie the structure held by the clamp *again* and *thus* avoid a tragedy real or potential. Don't put on clamps and expect to tie later. The clamp pulls off and the cystic artery is loose. There will be sharp hemorrhage and common and hepatic ducts may be injured in a blind application of clamps and ligatures.

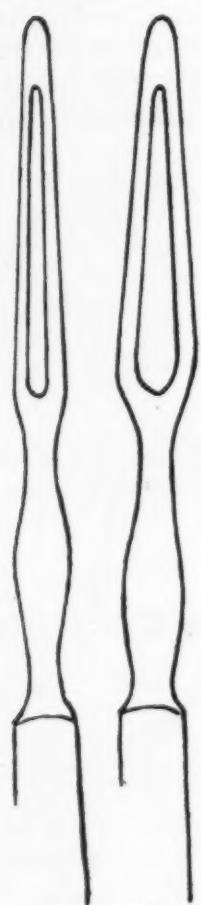


FIG. 3.—Modified Kocher Dissectors. (Two sizes.)

Removal of the Gall-bladder from Above or Below.—Many of these operations are simple, that is, there is a good exposure of the dangerous triangle and the pathological changes have not materially obscured the normal anatomy. Under these conditions the routine procedure—dissecting off of the overlying fatty peritoneal layer from the ampulla to the common duct—gives a clear view of the cystic and other ducts and permits of the easiest procedure—retrograde cholecystectomy. The cystic duct is doubly ligated with catgut. The distal ligature is further reinforced by a clamp. Division with cautery for asepsis with a view to closure without drainage.

In the typical difficult cases there is a massive infiltration of the area of the dangerous triangle, sometimes calcareous, and there is no normal anatomy in sight. Any attempts at dissection causes diffuse bleeding and makes a hard situation harder, and offers dangerous possibilities of wounds to the hepatic and common ducts and other important structures. The procedure at its best is time consuming and the (generally) unfavorable subject is subjected to the prolonged deadly anæsthetic.

It is in these conditions that the subserous excision from above is a life-saver. To perform it properly presuppose keen knives and eyesight and a delicate touch.

The peritoneal coat from the fundus to the ampulla is incised, exposing the mucous membrane. (Fig. 1.) When the right layer has been entered after patient dissection, the gall-bladder is easily shelled out of its bed as a pea out of a pod. (Fig. 2.) Haberer's modification of the Kocher hollow sound (two sizes) greatly aids in the dissection. (Fig. 3.)

Finally the gall-bladder has for its only attachment the readily visible and accessible cystic duct which is then readily ligated without possible harm to other structures and without hemorrhage.

The sealing of the cystic duct after ligature must be done by burying it in a fatty peritoneal bed, usually a structure adjacent to it. The temptation is strong to use one of the fatty tabs from the upper surface of the transverse

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colon. If this step can be carried out without compressing the duodenum by the displaced tab, all is well. Next comes a similar structure from the gastro-hepatic omentum.

In fat people either of these procedures are available. In thin persons a suitable fatty flap may not be available without distortion or compression, and the procedure should be abandoned and the wound drained. Failure to realize the disadvantages of this torsion tension resulted once in the leakage of the cystic duct necessitating secondary drainage with a prolonged convalescence.

The last step is a running catgut suture closing the serous membrane from which the gall-bladder has been removed. If drainage is employed some form, large or small, of my rubber dam Mikulicz † is the best. It is easily removed, never allowing gauze to come in direct contact with the tissues.

My cases closed without drainage have had short and comfortable convalescences, free from immediate discomfort and pulmonary manifestations, and the later results immeasurably better. These results have contrasted with many nice cholecystectomies complicated by drainage who returned with many symptoms of disturbance due to adhesions. Five times I have had to do a gastro-enterostomy following cholecystectomy with drainage where the obstruction to the duodenum could not be otherwise dealt with satisfactorily. (All five of these cases have good end results.) None of the closed cases has developed a hernia.

† Gibson, C. L.: The Rubber Dam Mikulicz Tampon. *ANNALS OF SURGERY*, April, 1921, p. 471.

TUBERCULOSIS OF THE MESENTERIC LYMPH-GLANDS

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TUBERCULOSIS of the mesenteric lymph-glands—*tabes mesenterica*—has long been recognized as a clinical entity. Until the latter part of the 19th century it was a diagnosis frequently employed to cover a group of cases in children characterized by malnutrition, swelling of the abdomen, and frequent copious stools. The diagnosis was a clinical one and there were doubtless included within its scope many cases of tuberculous peritonitis, of rickets, and of simple malnutrition. With the advance in clinical discrimination the other conditions were weeded out and there emerged a varied clinical, but definite pathological entity which is sufficiently frequent to be of real importance.

The work on the subject has been done mostly by French and German authors. There have been numerous articles in the English and American literature but no one that is comprehensive. The result is that even to-day the condition is not generally understood in the diversity and seriousness of its clinical manifestations. This is attested to by an examination of the literature. Search through the principle American and English text-books has failed to afford a satisfactory discussion and in the corresponding periodicals I have been able to find no extensive collection of cases, although the articles of Corner^{1,4} and Carson² are excellent presentations of relatively numerous personal observations.

The largest series encountered is that of slightly less than 100 cases collected and reported by Floderus in 1912.

In view of these facts it seems worth while to report the following instance of one of the serious complications and by reference to more complete studies present a picture of the disease.

CASE I.—Tuberculosis of mesenteric lymph-glands. Free perforation of a caseo-calcareous mass; operation: Excision of one gland; curettage and suture of another; appendectomy; recovery.

S. W. G. H., No. 179. R. L., a single male, university student of twenty years, was brought to the hospital, March 31, 1925, complaining of severe abdominal pain.

The family history was negative. No history of tuberculosis. His past history was essentially negative with the exception of the fact that when ten years old he had scarlet fever and for several months afterwards had intermittently a slight evening rise in temperature and for a year was in a relatively poor health. From that time until the onset of the present illness he had been perfectly well, had developed normally and been robust and active.

His present illness dated from the evening of admission. While engaged in a game of water basketball he noted, towards the end of the game, vague abdominal pain, and more than usual shortness of breath. He had to call time out several times to recover. On arriving home he felt nauseated. The pain had been growing steadily worse and was now severe enough to make him double up and roll on the floor of his room. A

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physician was called who relieved the pain by giving morphine. He was brought immediately to the hospital. There were no other symptoms. The pain was general over the whole abdomen but worse on the right side, especially in the right lower quadrant.

Physical examination showed a remarkably well-developed and well-nourished young man lying on his back in bed with his knees flexed. He was apparently suffering considerably. Practically no abnormalities were found except in the abdominal examination. The abdomen was held tense and moved very little with respiration. It was tender throughout and there was definite spasticity of all the muscles. This was most marked on the right side and especially in the lower quadrant where the rigidity was board-like and the tenderness acute. There was rebound tenderness. No masses or fluid made out but the examination was unsatisfactory on account of the spasm. Temperature, 99; pulse, 84; respiration, 20; white blood-cells, 11,000. Diagnosis—acute appendicitis.

He was operated upon by Dr. A. S. Crawford shortly after admission.

Operative Note.—McBurney muscle splitting incision. On opening the peritoneal cavity small pieces of material resembling cream cheese were found free in it. The appendix was found to be essentially normal. Exploration, after widening the incision, revealed a group of enlarged caseo-calcareous glands at the root of the mesentery of the small intestine. The omentum was adherent about them. The largest, about the size of a hen's egg, had ruptured and from it whitish, cheesy material was escaping. The remaining contents were scraped out and the cavity infolded with catgut sutures. One of the other glands was removed for diagnosis. Appendectomy was performed. Closure with drainage.

Culture from the peritoneal cavity showed no growth at the end of forty-eight hours.

Pathological Report.—Caseo-calcareous tuberculous lymphadenitis.

With the exception of a mild attack of broncho-pneumonia he had an uneventful post-operative course and was discharged from the hospital on April 27, 1925. His wound was well healed. He was told to return regularly for continuation of ultra-violet treatments started while he was in the hospital.

Subsequent Course.—The patient was perfectly well until September, 1925, five months after his discharge, when shortly after eating his noonday meal, he was taken with cramp-like pains in his epigastrium followed by nausea and vomiting. He continued with the nausea and vomiting and pain throughout the afternoon and evening. The next day he was well enough to go about his work.

He had another similar attack a short time later.

November 20, he had another attack, not related to eating, of cramp-like pains in the epigastrium, nausea and vomiting. This lasted for two days, finally forcing him to go to bed and lie with his legs drawn up. The third day he was sufficiently improved to be up and about. He has been well since. He maintains his weight.

X-ray Examination.—November 25, 1925, gave the following findings: "Stomach and duodenum negative under the screen. Plates show antrum somewhat cut off. Cap incompletely filled without showing any defect. Twenty-four-hour plate shows marked spasticity of colon. Residue on the right and left side visualized in transverse colon as irregular line."

DISCUSSION: Definition.—What term should be applied to the condition and what cases should be included within the category have been matters of discussion. Many of the earlier writers (Machtles-Floderus⁵) used the name "Primary Tuberculosis of the Mesenteric Lymph-glands," while Gehrels⁶ preferred the term "Surgical Tuberculosis." It is agreed by all that instance of involvement of the glands, secondary to acid-fast enteritis or in the presence of diffuse tuberculous peritonitis, should be excluded. The former term Gehrels holds, and I believe justly, to be too narrow, including as it does, only

those cases where the lesions in the mesenteric glands are the only ones demonstrable in the body. This definition is of interest from the etiological point of view rather than the clinical. Clinically all cases present the same picture and problems in which involvement of the glands is the sole abdominal lesion. The presence of other foci in the glands of the neck, in the lungs, or elsewhere is of secondary importance.

Etiology.—The mode of infection is ingestion and the route is through the intestinal mucous membrane to the glands which drain it. The bacilli may be ingested either in the milk or milk products of tuberculous animals or, in persons suffering from pulmonary tuberculosis, may be swallowed in the sputum. In a high percentage of instances the organisms found are of the bovine type.

Whether or not the bacteria can pass through the bowel mucous membrane without producing a lesion is a matter of only academic importance, in view of the fact that in the cases here discussed, no evidence of intestinal involvement, even in those which came to autopsy, could be found. If there had been lesions they were microscopic and healed. In this connection it should be added that it is not unusual to encounter tuberculous cervical adenitis with no demonstrable disease in the tonsils or in the buccal or nasal mucous membrane.

Incidence.—In 1912, Floderus was able to collect something less than 100 cases. This is a poor indication of its incidence for over one-half of these were reported (as occurring in their own experience) by three authors. Since then Carson² has published a series of fifty cases and Iselin³ one of eight of acute perforation, Kieler in 15,000 post-mortem examinations found the condition in one per cent. Bertzke presented similar figures. Osler and McCrae¹⁹ state that Bovaird at the Mt. Sinai Hospital, New York, found the incidence at post-mortem as less than one per cent., while John Thomson reports it as 3.54 per cent. for Edinburgh and 4.51 for Glasgow. It is probable that the condition is often latent, proceeding to a spontaneous cure without producing symptoms. It is certain that many cases are not diagnosed correctly. Among these are doubtless many of the instances of persistence of symptoms after operations for chronic appendicitis and also many of the cases of unexplained malnutrition in children.

Floderus found that two-thirds of the cases occurred in the first fifteen years. It was most frequent between the ages of five and ten. While these figures indicate that it is primarily a disease of childhood emphasis should be placed upon the fact that it is not infrequent in youths and adults. Gehrels calls attention to the fact that the surgical complications, especially ileus and perforation, are more frequent in young adults than in children. The case here presented is an example. Floderus found more boys affected than girls.

Pathology.—The lymph-glands of the mesentery of the small intestine, numbering between one and two hundred, are arranged in three rows, the first composed of small glands lying close to the bowel—the second of ones slightly larger, lying farther out, and the third of still larger glands grouped

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at the root of the mesentery. These latter receive the drainage from most of the large intestine as well as from the small.

In the mesentery of the large bowel the lymph-glands are much less numerous, numbering not more than twenty to thirty. The most important of these are the ileocaecal group which are subdivided into anterior and posterior and follow generally the course of the ileocaecal artery, the lymphatics from them emptying into the glands at the root of the mesentery of the small intestine. The glands of the rest of the large bowel drain similarly with the exception of those of the sigmoid from which the vessels pass directly to the lumbar retroperitoneal glands.

This outline of the anatomy is of considerable importance in a consideration of the pathology and of the symptomatology.

From the point of view of distribution of the lesions Gehrels divides them into two groups—the localized and the diffuse. The first (the most common) is characterized by the formation locally of large tumors—usually composed of numerous glands matted together; the second by a diffuse involvement of the glands over a large area. He says that the former type progresses less quickly to caseation and calcification and an arrested state. The second type, on the other hand, often represents a more virulent infection, is less easy to diagnose on account of the absence of a tumor, and the glands are more likely to undergo caseous and purulent degeneration. For this reason he considers it more dangerous than the other and more likely to lead to serious complications, especially to adhesions and ileus.

He quotes Payr as making the following classification: 1. Multiple small glands near small bowel. 2. Larger glands matted together near root of mesentery. 3. Tuberculous gland tumors of the ileocaecal region.

The ileocaecal glands are most frequently affected and for this reason the tumor is most often on the right side. In twenty-five instances Thieman found it on the left in only two. Pagenstecher says that the order of incidence is first ileocaecal glands; second, those at the root of the mesentery; third, those of the ascending colon; and fourth, those of the sigmoid. The glands at the root of the mesentery are of great importance, receiving as they do, the flow from most of the others. For this reason they are very frequently affected, and their location retroperitoneally and in close relationship to the blood supply of the bowel, makes them of great clinical significance.

The tuberculous lesions in the glands themselves are similar to those in glands in other locations. The finding at any certain time is dependent upon the stage of the process. The course is governed by the ratio between the virulence of the organism and the resistance of the individual. It has been suggested that in the mesenteric glands there is a greater tendency to calcification. The primary lesion is, of course, the tubercle. These tend to become conglomerate and produce swelling—simple hyperplasia. Probably in most instances, fibrosis, caseation, and calcification proceed hand in hand and the process is brought to a termination without the production of symptoms or of great enlargement. The hyperplasia may, however, become marked, caseation

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may out-distance the process of repair, and large caseous tumors be formed. If the infection is virulent, or if secondary infection occurs, pus may be formed. In the clinical cases this is very common.

Of great importance is the extension of the process through the gland wall—the development of periadenitis. In some instances this process is gradual, and in others there is a sudden rupture of a purulent or caseous mass. In the former case there is produced a local peritonitis and adhesions. If numerous glands close together are involved they become matted together into a knotty tumor, adherent to surrounding viscera. This may produce complications. Sudden rupture of a purulent or caseous tumor is not uncommon. This may lead to a generalized tuberculous peritonitis, or if there is secondary infection, to an acute septic peritonitis (Rotch, Iselin and Floderus report such accidents).

From a clinical point of view the effect of the process upon the surrounding viscera is of great importance. The formation of kinks and bands has already been mentioned. When the glands at the root of the mesentery are involved there results often a lymphatic obstruction and a dilatation of the efferent lacteals. Enlargement of these glands may interfere seriously with the circulation of the bowel, in some instance even to the production of gangrene. Cases have been reported of obstruction by pressure of the common bile duct, of the ureter and of the pylorus and duodenum.

If pus formation is extensive, large cold abscesses may be formed. These, if in the mesentery, usually rupture into the bowel or bladder; if retroperitoneal, in the glands at the root of the mesentery, the pus will burrow and discharge as a psoas abscess or through Petit's triangle. Gehrels mentions one case in which an umbilical fistula developed.

Symptoms.—There have been attempts to establish for the condition a typical clinical picture. These are misleading, for, while certain syndromes are more common than others, the disease is characterized by the variety of the ways in which it makes itself manifest, and it is this aspect of it which needs emphasis. How great this variety may be can be surmised if one considers the wide distribution of the mesenteric glands—any one of which or any group of which may be affected, and the great differences in the acuteness of the process as it is determined by the ratio between the virulence of the organism and the resistance of the individual.

The disease may be silent, progressing to healing or to an advanced stage with the production of no noticeable symptoms. In many instances it runs a chronic course, with or without acute exacerbations, over many years. On the other hand, the first symptoms may be so acute as to lead to immediate operation, or they may be those of one of the late complications, ileus, perforation, or pressure upon the common bile duct, duodenum or pylorus. In the series reported by Floderus the average duration was three months, the longest—years and the shortest, of course, only a few hours. In a series of fifty cases, Carson found the mean duration to be seven to eight months, the longest thirteen years, the shortest similarly a few hours.

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Occasionally the onset of the disease is determined by some acute infectious process. The present case and that reported by Melman¹¹ are examples. In both there was persistence of temperature after the attack of scarlet fever in the first instance and influenza in the second.

In the chronic cases, the initial and presenting symptom is most often pain. This is usually intermittent. It may be vague and transitory or relatively sharp and colicky and more persistent. It is often drawing and dragging. It rarely has any relation to any of the bodily functions. It may be located in any part of the abdomen, the location being determined by the particular gland or gland group involved. Because the ileocaecal glands are most often affected, it is most often in the right lower quadrant. It may be in the right upper quadrant from involvement of the glands of the ascending colon, or in the epigastrium¹⁰ from those in the transverse mesocolon or over the pancreas. Rarely it is on the left side. In many instances (probably in connection with disease of the glands at the root of the mesentery) it is referred to the region of the navel. In this connection the Germans have described a more or less typical "Nabelschmerz" seen most often in children. Carson² describes it as follows:

"It is a sudden centralized abdominal pain, severe enough to make the child cry, lasting about five minutes or less, relieved by pressure and hot applications, recurring perhaps two or three times a day and stopping as suddenly as it began, so that in the intervals the patient is quite free. In some cases pain occurs every day, in others only at intervals of a month or so, the attack lasting two days. Vomiting occurred at the time of the pain in thirteen of the typical cases." Carson attributes the pain to a reflex colic incited by irritation of the vagus filaments in the mesentery. This may be so. It is certain that in some instances it is associated with meteorism and is typical of that caused by adhesions. The acute exacerbations may be caused either by secondary infection with pyogenic organisms, or by the penetration of the infection through the gland wall with the instigation of a local peritonitis. The acute symptoms of free perforation will be discussed later.

A chronic course of this nature is very often punctuated with acute exacerbations. These simulate in practically every respect attacks of intraperitoneal inflammation due to other conditions. There is increase in pain which is persistent and steady. There is often vomiting and the temperature and leucocyte count are elevated and the affected part of the abdomen is tender and spastic. The symptoms may be very severe.

Only occasionally, says Gehrels, are the presenting symptoms loss of weight, appetite, and strength—many of the patients are well nourished and robust. In a certain percentage the general nutrition is affected and in silent cases this may be sufficiently marked, especially if associated with slight rises in temperature, to lead to the suspicion of and search for a latent tuberculous focus.

There may be periods of slight daily rise in temperature. During the acute attacks it is always elevated and may rise to 40 degrees C. Miliary

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tuberculosis complicates the condition more frequently than any other and a persistent high fever may indicate the development of this complication.

For the older clinicians the nature of the stools was one of the characteristic findings. These were described as frequent, foul smelling, thin, voluminous, light, shiny, and rich in fat. In many of the reported cases they were of this nature, but the symptom was far from constant and functional constipation or chronic mechanical obstruction are not uncommon. The thin voluminous fatty stools are doubtless the result of the lymphatic obstruction and the consequent hindered absorption of fat.

The chief dangers of the condition lie in its complications. Of these ileus, free perforation, abscess formation, pressure on other organs, and miliary tuberculosis are the most common. Hemorrhage has been reported and also mesenteric thrombosis.

As has been noted earlier acute ileus may be the first symptom. Homuth⁸ has reported one such instance and Bruning¹ two. Ileus was met with ten times in a series of fifty-three cases reported by Prutz. There were seven cases in the fifty reported by Carson. Of these three were caused by intussusception. Often there are symptoms of chronic obstruction for a longer or shorter period before the acute onset. These are obstipation and recurrent attacks of meteorism accompanied by cramp-like pains. Vomiting may occur with the attacks. The causes of the obstruction have been discussed under the pathology and the symptoms and treatment are too well known to require description.

Gradual extension of the process through the gland surface may produce a generalized tuberculous peritonitis. More often the peritoneal infection is local, the inception of this doubtless accounting for some of the acute exacerbations, and the resultant adhesions for the late ileus.

When abscesses form, if they are of the typical "cold" variety, the symptoms may be relatively slight. If the process is acute or there is secondary infection, there may be high temperature, pain, spasm, tenderness and tumor. In many of the cases operated upon during an acute exacerbation there was found a conglomerate mass of caseous and purulent glands. The acute symptoms may terminate abruptly on the rupture of the abscess into the bowel, bladder or stomach. Iselin has reported one instance of spontaneous drainage *via* the umbilicus.

Acute and free perforation presents a much more striking picture. It is that typical of perforation peritonitis. There is the sudden onset of severe knife-like pain followed by vomiting and collapse. In two instances trauma seems to have caused the rupture. Examination shows the abdomen board-like and exquisitely tender. Rebound tenderness is marked. Of such an occurrence the present case is an excellent example. The outcome of it depends upon the type of gland which has ruptured. If it is an acute tuberculous process a general infection of the peritoneum may result. If there is secondary infection the peritonitis may be septic. Rotch reported one such case in an infant of eighteen months. If the ruptured gland is of the far-advanced

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caseo-calcareous type, there may be produced nothing more than the inflammation of sterile irritation. In such cases the gland has become what might be termed a tuberculous cyst and it is this type that may be broken by trauma.

Hepburn⁷ has reported three cases and Valentine¹⁸ one of hydronephrosis produced by pressure of caseous or calcareous glands upon the ureter.

In Floderus' series there was one instance of painless and persistent jaundice from pressure upon the common bile duct, another of ascites secondary to obstruction of the portal vein.

Physical Findings.—The patient may present the pallor and general poor nourishment typical of tuberculosis. Equally as often, or more often, he will be well-developed, robust and apparently in the best of health.

There may be evidence of other tuberculous foci, enlarged cervical glands, scars in the neck, tracheobronchial lymphadenitis, or signs of a latent or active pulmonary lesion.

The findings on abdominal examination will depend upon the nature and acuteness of the process. In the chronic cases there may be nothing but deep tenderness. During acute exacerbations or perforation there will be spasm and acute localized tenderness. In the clinical cases tumor is a relatively constant finding. In Floderus' series it was absent in only eight. The size may vary from one just large enough to be palpable to a tumor as large or larger than a man's fist. It is usually tender and slightly movable, but can be felt to be attached posteriorly. It is most often on the right side of the abdomen, especially in the right lower quadrant, but may be any place. They have been mistaken for appendiceal abscess, floating kidney, gall-bladder, cyst of the pancreas, in fact almost every variety of abdominal tumor. Rectal or vaginal examination may disclose a mass not palpable through the abdominal wall. The leucocyte count will vary with the acuteness of the process. Unless there is secondary infection it will be that typical of tuberculosis.

The temperature and stools have been discussed under the symptomatology. The von Pirquet test will be positive, in infants and children, a finding of considerable value.

Diagnosis.—A correct pre-operative or ante-mortem diagnosis is unusual. In Floderus' series it was made only seven times. The condition may simulate almost any acute or chronic intra-abdominal disease. That most frequently simulated is chronic or acute appendicitis. This is accounted for by the fact that the ileocaecal glands are most commonly affected. It is probable that this is the pathology in a certain number of persons who are not relieved following operations for chronic appendicitis. Payr cites as differential points the frequent absence of vomiting and the location of the point of tenderness between McBurney's point and the umbilicus.

The pain may mimic very closely that caused by renal colic, gall-bladder disease, or gastric or duodenal ulcer. Acute exacerbations in glands in the region of the sigmoid are most often mistaken for diverticulitis. Other conditions for which it has been mistaken are intestinal colic, obstipation, foreign

body in the bowel, intestinal and peritoneal tuberculosis, adhesions and ileo-caecal tuberculosis.

Treatment.—Treatment may be either medical or medical and surgical. The former consists in rest out of doors, tonics, forced nourishment and ultra-violet therapy. X-ray treatment may be used. Floderus is responsible for the statement that the clinical cases do not do well under this régime. Especially is this so where the condition has advanced to a stage where accurate diagnosis is possible, when the glands are large and a tumor is palpable. It is his opinion, and that of most others who have written upon the subject, that such cases should be subjected to operation. In actual practice in most instances the diagnosis is not made until the abdomen has been opened. The difficulty in diagnosis thus illustrated is a further argument in favor of exploration.

The procedure at operation must, of course, be determined by the nature of the pathology encountered. The following methods have been used:

- a. Simple exploration.
- b. Enucleation of the affected glands.
- c. Enucleation of the affected glands combined with resection of the dependent piece of bowel.
- d. Opening and curetting and packing with iodoform gauze and infolding with suture caseo-calcareous gland masses.
- e. Drainage of abscesses.

It has been suggested that simple laparotomy was beneficial in the same way that it was one time supposed to be for tuberculous peritonitis. There is little reason to believe this possible, and practically no clinical evidence to support it.

Where it is possible, enucleation of the affected glands, or at least the largest of them, is the method of choice. In doing this there is always danger of injuring mesenteric vessels that are essential to the vitality of the bowel and this danger is especially marked when the glands are at the mesenteric root. Because of the involvement of the vessels in the process, it is sometimes necessary to resect the corresponding segment of bowel. In such instances the abdomen can be closed without drainage.

In case the involvement is too extensive to permit of enucleation or enucleation and resection, caseous or caseo-calcareous glands can be opened, emptied and curetted and then either swabbed out with iodine and infolded by suture or the cavity packed with iodoform gauze.

In case of abscess formation, drainage with extirpation of all glandular tissue possible is, of course, indicated.

After acute perforation, if the gland ruptured was of the caseous type, closure without drainage is permissible.

The treatment of ileus and the other complications is too well known to require discussion.

Operation should be followed by a prolonged course of medical and general hygienic treatment and by careful and frequent observation.

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Results.—The following statistics have been tabulated from a series of 78 unselected cases:

Post-operative deaths	8
Operated too recently to be of value	6
Total cases followed more than six months	50
Well from six months to ten years	32
Nearly well	10
Died of the disease	2
Died of other diseases	2
Died of miliary tuberculosis	3
Recurrence and re-operation after nine years	1

SUMMARY

1. A case is reported of rupture of a caseo-calcareous tuberculous gland of the mesentery and a survey of the literature is presented.

2. The term "Surgical Tuberculosis of the mesenteric lymph-glands" is preferred to "Primary Tuberculosis" in order to include within the category all instances in which the lesions in the glands are the only ones in the abdominal cavity.

3. In Floderus' series two-thirds of the cases occurred between the fifth and tenth years. It may occur in infants and is not uncommon in youths and adults. The serious complications, especially ileus and perforation, are more likely to occur in the older patients.

4. The mode of infection is ingestion and the route is through the intestinal mucous membrane to the glands that drain it. In a majority of cases the bacilli are of the bovine type.

5. The pathology is that of tuberculosis in glands in other locations. In general there are two types—the diffuse and the localized. Many of the symptoms and complications are secondary to peri-adenitis and adhesions or to chronic or acute perforation of purulent or caseous glands. These may be secondarily infected.

6. While certain syndromes are more common than others, the disease is characterized by the diversity of its clinical manifestations. There may be no symptoms, the picture may be one of chronic abdominal pain, with or without acute exacerbations. The first symptoms may be acute, due either to an exacerbation of a latent process or to one of the complications.

7. The physical findings are as follows:

- (a) There may be poor nourishment and development, but as often as not the patients are in good physical condition.
- (b) There may be another tuberculous focus in this body.
- (c) In most instances there is an abdominal tumor. This may be located in any part of the abdomen. In a majority it is in the right lower quadrant.
- (d) During the acute exacerbations there is a tenderness and spasm.
- (e) The stools may be foul, copious, shiny and rich in fat.

8. Ileus, abscess formation, chronic or acute perforation, and pressure upon the duodenum, the common bile duct, the ureter, or the portal vein, and miliary tuberculosis are the chief serious complications.

9. The diagnosis is difficult and is rarely made prior to operation. The condition most often simulated is chronic or acute appendicitis, but the symptoms may suggest almost any abdominal condition. The X-ray will show calcification if present and in children a positive von Pirquet reaction is of value.

10. The treatment is medical and surgical. The former is the same as for surgical tuberculosis in the other regions. The operative procedure indicated will be determined by the stage of process.

1. Extirpation of glands where possible.
2. Extirpation of glands and resection of the bowel where injury to the mesenteric arteries is unavoidable or where there is gangrene.
3. Drainages of abscesses.
4. Opening and curettage of caseo-calcareous masses with subsequent packing or infolding suture.

11. In 78 cases there were 8 post-operative deaths. Two of these were complicated by ileus and 2 by rupture of a secondarily infected gland. Of the remaining 70, fifty were followed "longer" than 6 months. Of these 32 were well, 10 nearly well—1 required re-operation after 9 years, 2 had died of other diseases, 2 of the disease itself and 3 of miliary tuberculosis.

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PYEOGRAPHY IN THE DIAGNOSIS OF TUMORS OF THE FLANK

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TUMOR masses occurring in the flank, *i.e.*, that area bounded by the ribs, iliac crest and linea semilunaris, often present many difficulties of diagnosis. Indirect surgical approach or two incisions are the results of error. This discussion does not deal with the simple acute gall-bladder mass or appendiceal abscess, but with those flank masses of unusual origin or course. The determination as to whether they are intra- or retro-peritoneal, the type of disease and the degree of tissue destruction determine in a measure the nature and extent of proposed treatment. Symptoms and clinical signs are too often inconclusive, inaccurate and require a line of deduction not justified by the observations.

We are driven to seek the absolute evidence, for even to-day an exploratory operation is too frequent, when more definite methods of diagnosis would save the patient two incisions and some operative shock. In the following we wish to show the value of a properly taken and properly interpreted pyelography.

To illustrate, pyelitis and cholecystitis in women past middle life frequently co-exist and are the source of error as to the cause of acute abdominal symptoms.

We have seen the combination of a Riedel's lobe, a ptosed liver, an enlarged gall-bladder and the whole walled off by a mass of omentum, filling the right flank and associated with signs of acute renal infection when the diagnosis between the two conditions could be reached only by a careful cystoscopy and a pyelography. The mass could be an acute pyonephrosis upon a long-standing renal pelvic dilation, a subrenal abscess or an acute empyema of the gall-bladder, an intraperitoneal tumor of other origin, or a retroperitoneal tumor or abscess, or a misplaced or pyonephrotic ectopic kidney.

A simple pyelography in such a case may show a normal renal pelvis, thus excluding intrarenal disease in the presence of a mass large enough to be palpated and yet it is not conclusive, since it gives no positive evidence regarding the relation of the palpated mass to the kidney. The history, clinical signs and results of general and local physical examination may be inconclusive so that one resorts to the urologist for special evidence. He should have had a thorough general surgical training from which he must have retained a knowledge of abdominal surgical problemis. In such cases we have placed a coin over the tumor on the surface and taken a pyelography. The direction of the ray and the relative distances of the kidney and mass from the plate must be considered.

PYEOGRAPHY IN TUMORS OF THE FLANK

With the aim of analyzing the value of pyelography in these cases we have divided them into three groups:

1. Differentiations of intraperitoneal from retroperitoneal masses (perirenal, subrenal and renal).
2. Extrarenal (retroperitoneal) from intrarenal masses.
3. Intrarenal masses.

In making these differentiations we have used six factors as observed in the X-ray from which to draw our conclusions.

1. The position of the kidney; the normal being with its pelvis opposite the first or second lumbar intervertebral spaces. Variation from this must be explained by hypermobility due to one of the known causes or displacement by being pushed by tumor masses or drawn, *e.g.*, by inflammatory processes.

2. Disturbance of the normal longitudinal renal axis. This is accepted (Kelly and Burnam) as obliquing toward the spine cephalad, at an angle of 15°.

3. Disturbance of the normal antero-posterior axis or rotation of the kidney on its vessels as an axis (Braasch).

4. Distortion of one or more calyces of the pelvis; typically seen as caused by pressure on the kidney from an extrarenal mass. The entire pelvis and calyces are present but elongated or distorted by pressure.

5. Absence of a part or all of one or more calyces. This, in our experience has been brought about more commonly by intrarenal masses, abscess or tumor, by which a calyx has been destroyed or obliterated by pressure, so that the solution does not enter it.

6. Fragmentation of the pelvis or calyces which constitutes a typical picture of tumor close to the true renal pelvis.

The above three locations of tumor masses with their pyelographic diagnosis are illustrated by the following cases:

I

An intraperitoneal tumor mass entirely separate from the kidney and adrenal can be differentiated from the kidney by placing a coin on the abdomen over it and making a pyelography.

CASE I.—*Acute Cholecystitis vs. Kidney.*—(No. 2075.) Female, fifty-six years old. No previous illnesses. Four days before seen, she began to have slight pain in the right hypochondrium, which became worse and colicky in character and was not referred. Nausea and vomiting. She had had a similar attack eight years before.

Examination.—Fairly well nourished woman, of good color. No jaundice. Abdomen showed a full, rounded body on the right side, extending two inches below the level of the navel, descending on inspiration, movable laterally, not tender and extending back to the right kidney region and filling the flank on bimanual palpation. The urine contained pus and albumin two plus. Cystoscopy showed no accessory ureteral openings and a pure culture of colon bacilli. Pelvic examination showed the uterus and adnexa normal. Pyelography—Fig. 1.

In making the pyelography two coins were placed over the palpated mass and a pyelography taken. The outline of the kidney was clearly seen; its pelvis was normal

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while the coin shadows were shown to be lateral to the kidney and over the palpated mass. The tumor was therefore independent of the kidney.

Conclusion.—Tumor of gall-bladder origin.

At operation by the abdominal route an enormously distended gall-bladder with a Reidel's lobe and omental mass was found. Cholecystectomy. Recovery.

CASE II.—*Acute Cholecystitis with Gall-stones vs. Kidney.*—(No. 2148.) Female, thirty-four years old. Examined for Doctor Hamann. Patient had had her appendix

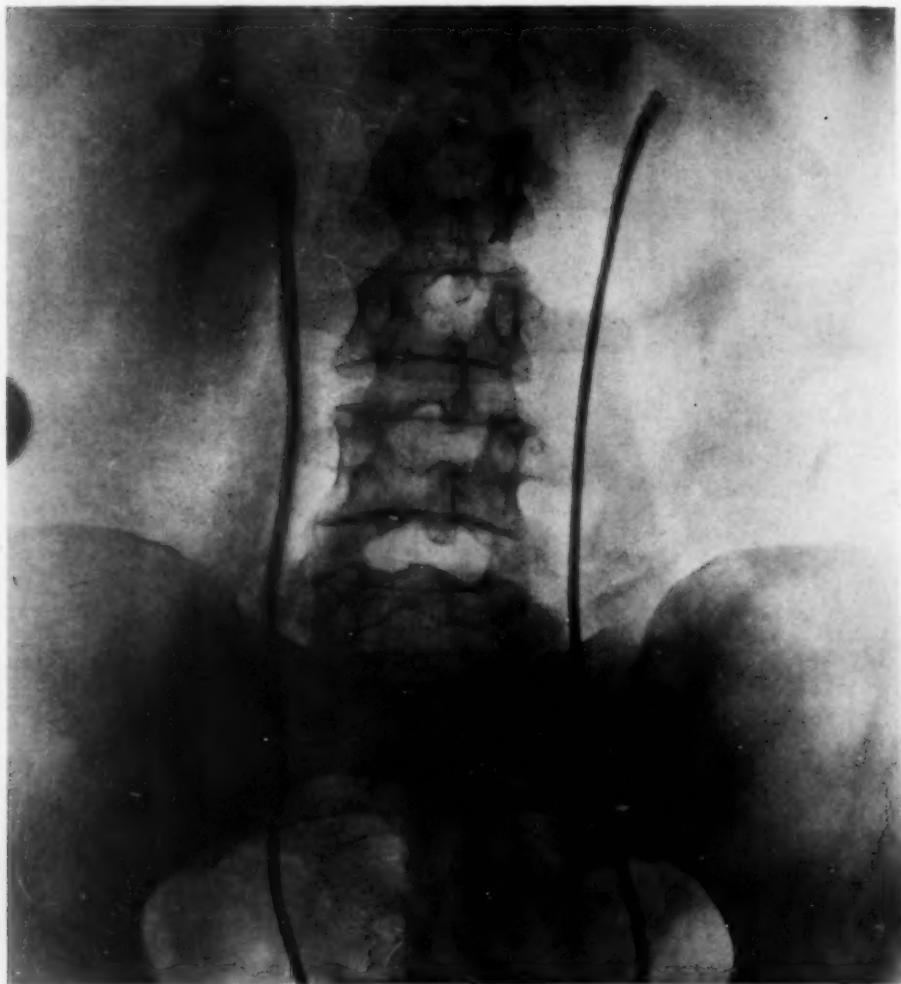


FIG. 1.—Coin placed over palpable tumor (gall-bladder). Normal pyelography.

removed ten years previously. Four weeks before seen and four weeks after childbirth, she had a severe pain in the right lower quadrant of the abdomen originating in the same region as the old appendix; pain of a dull character which continued to the present.

Examination.—Poorly nourished, slender, anaemic woman. Abdomen slightly irregular, showing a very tender mass in the right iliac fossa and extending upwards, filling the right flank. The mass did not descend on inspiration. There was tympany between it and the costal border. It was not movable. The abdominal wall was atrophic in type; no muscular rigidity. Temperature 101° ; white blood-cells eighteen thousand. The urine

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contained albumin and pus one plus. Because of its filling the right flank as felt by bimanual palpation, the mass was thought to be of kidney origin.

Cystoscopy.—Catheters passed easily to both kidneys. Clear urine was obtained from both with negative cultures. P. S. P. appeared on the right side in three minutes and on the left side in three and a half minutes. An X-ray with probes and a coin outlining the tumor as felt on the surface showed the kidney to be separate from the mass palpated. It however showed the ureter apparently pushed over towards the spleen by the mass. This has been noted in several cases in retroperitoneal, subrenal masses and

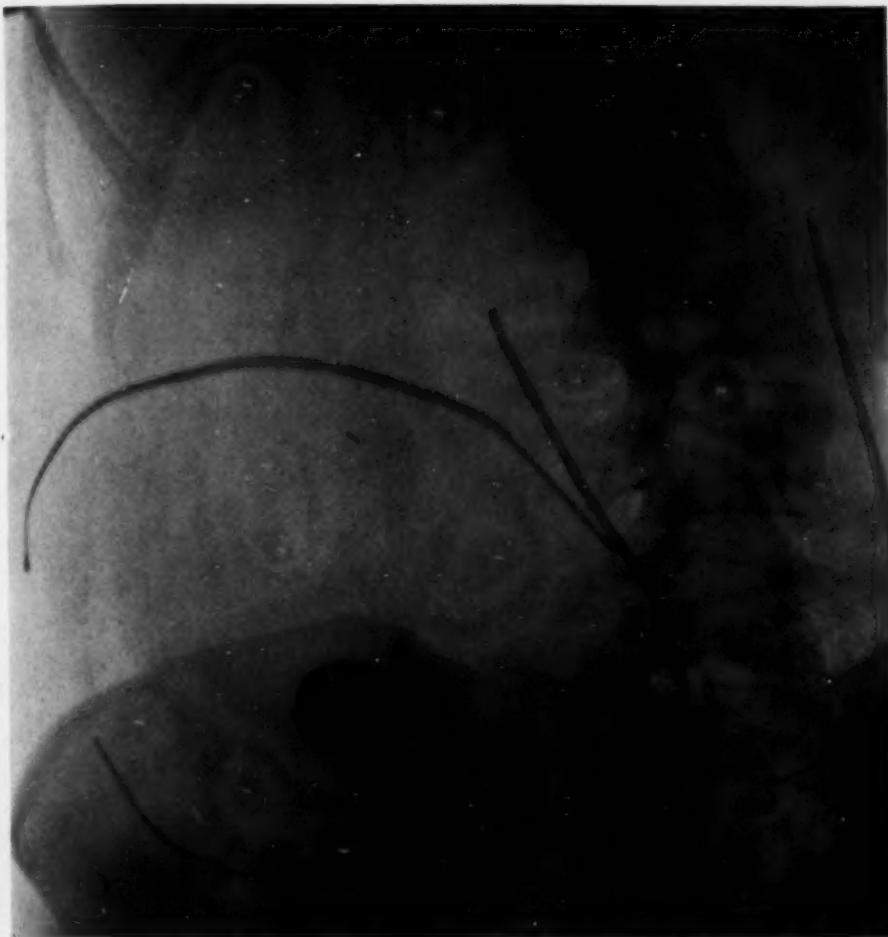


FIG. 2.—Coin over palpable tumor (gall-bladder). Probes outlining the same.

a diagnosis of retroperitoneal tumor was therefore made. (Fig. 2 without pyelography. Fig. 3 with pyelography.) In this case the mass was so large and was lateral to the colon, so that the latter being pushed towards the middle line carried the ureter with it.

Pre-operative Diagnosis.—Retro-peritoneal tumor in the right iliac fossa. Operation by the abdominal route, showed an enormously distended gall-bladder walled off by omental adhesions, and partly covered by a Reidel's lobe. In this case the fixation of the tumor mass, presence of tympany between it and the liver, and the pushing of the ureter to the middle line led to the error in diagnosis, but that the mass was free from the kidney was certain.

II

A retroperitoneal tumor above or below the kidney may be likewise differentiated and further so by the fact that a displacement of the ureter or kidney by the tumor is often present.

The ureter may be seen to curve over the surface of the tumor and pushed toward the spine by an abscess or outward from its normal position by, *e.g.*, a retroperitoneal sarcoma. In the foregoing haematuria will not be a constant factor, although its occur-

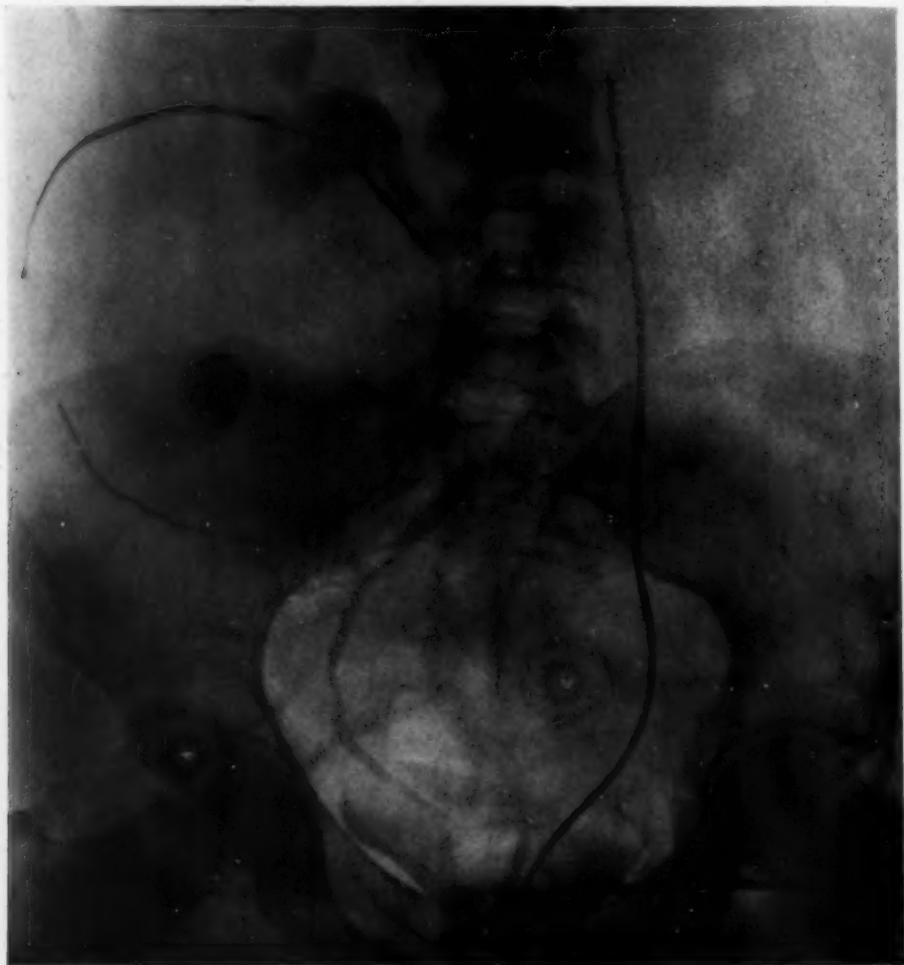


FIG. 3.—Same with pyelography. A slightly dilated pelvis and calyces due to pushing of the ureter to the left with partial obstruction, and a chronic pyelitis.

rence at one or more separated intervals may be due to a temporary venous engorgement. Pain occurrence is variable and of variable character. The cystoscopic findings are inconclusive or confusing in that a pyuria with positive cultures may be present.

CASE III.—Appendiceal Abscess vs. Kidney.—(No. 2227), Fig. 4. Male, thirty-five years old.

P. I.—Two years before seen he was taken with an attack of severe pain in the right flank. The pain was dull, aching in character and was referred along the genito-

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urinary tract to the bladder. *Marked increased frequency of urination*—pyuria. There was no vomiting. He had two such attacks of pain within three months of each other.

On X-ray, in other hands, a shadow interpreted as a stone was seen in the right kidney. He was operated, the kidney being split but no stone was found. Following operation he had two more attacks of pain and was then first seen by the writer with his fifth attack. He had chills, a temperature of 102° , *marked increased frequency of*



FIG. 4.—Coin over palpable mass, movable appendiceal abscess with pyelography showing a normal pelvis.

urination and pyuria. Examination showed marked rigidity of the entire right abdomen. No tenderness over McBurney's point nor the lower abdomen. White blood-cells—eighteen thousand.

On palpating the right flank, a body was felt descending on inspiration like a low kidney and could be distinguished by palpation from the kidney. Gross percussion posteriorly showed very marked tenderness over the right kidney. The urine contained albumin and pus, two plus.

The patient was watched for several days until the urinary output was increased and his temperature subsided.

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Cystoscopy showed a normal bladder and normal ureteral openings. A pyelography with a coin over the mass showed it to be below the right kidney. The kidney was high, could not be palpated, and showed a normal pelvis.

Diagnosis.—A chronic appendicitis. Retro-colic, retro-peritoneal abscess. Operation, appendectomy; drainage; recovery.

The occurrence of pyuria, at times haematuria and of pain referred along



FIG. 5.—Pyelography-kidney lying with its long axis antero-posterior from the subrenal mass, ureter pushed to the left.

the urinary tract has been frequently noted in appendicitis. These symptoms are of course due to the proximity of the appendicitis to the ureter, the extension of the inflammatory process to it and the reference of the pain partly by ureteral obstruction, due to swelling and pressure, producing renal colic and partly by cutaneous hyperesthesia confused with the tenderness at McBurney's point. In this connection the reference of pain from such

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disease to the right hip-joint might be mentioned. The genitocrural nerve, lying upon the psoas muscle, sends a branch to the hip-joint. Hence the occurrence at times of severe hip-joint pain both in appendicitis, ureteritis and other inflammatory processes of the urinary tract. Such cases could be cited.

CASE IV.—*Subrenal Abscess.*—(No. 2226), Fig. 5. Female, twenty-two years old. The patient was delivered of a badly macerated child at full term by Cesarean section.

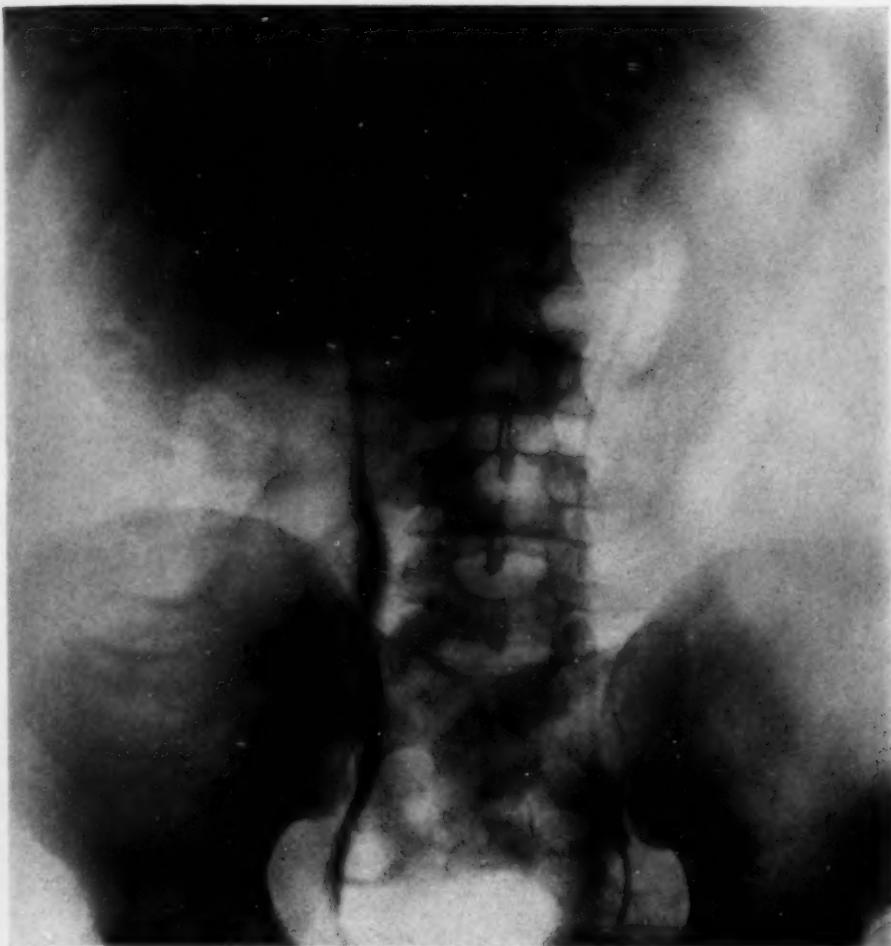


FIG. 6.—Normal pelvis; subrenal abscess of long duration.

Very marked colon infection of the uterus present. She progressed well until the seventeenth day, when she had a severe chill, temperature one hundred and three to four, with pain in the right flank, where a mass developed not distinguishable from the liver above, and extending two fingers below the navel, nearly to the midline, markedly tender, somewhat irregular and moved slowly forward on deep inspiration. No increased frequency of urination. Few white blood-cells and pus cells in urine. No haematuria. No attacks of colic.

Examination.—Showed the above-described mass. The urine contained albumin double plus, but this was present before childbirth. Blood-pressure 118-80. Right kidney

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on palpation was not tender. Obviously a perirenal or subrenal abscess was considered. An intraperitoneal mass, an ectopic infected kidney could not be excluded without special examination.

Cystoscopy showed a normal bladder and ureteral orifices. Number seven catheters were passed easily to both kidneys. P. S. P. appeared on the right side in five minutes; on the left side in nine minutes. The urine from the left side was paler in color than

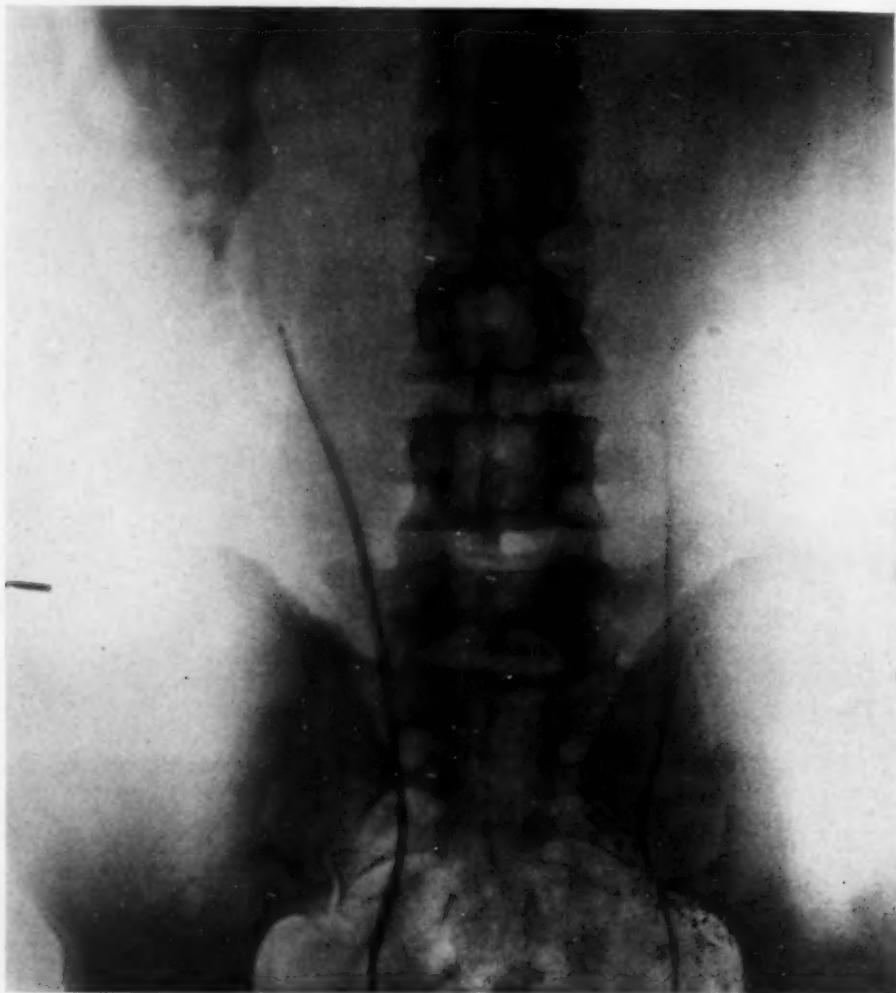


FIG. 7.—Normal pyelography ruling out renal tumor, the ureter displaced away from the spine at its upper end by the tumor.

that from the right, but both were clear amber. There appeared to be no disturbance of the kidneys, except the delayed P. S. P.

Pyelography showed the right kidney turned so that the axis was antero-posterior. Its pelvis was not dilated. The ureter appeared curved around the mass in the right flank. This mass was seen below the kidney, with a faint interval between the two.

Diagnosis.—Subrenal abscess. Drainage; recovery. This case illustrates rotation of the kidney on its antero-posterior axis.

CASE V.—Subrenal Abscess (Appendiceal).—(No. 2296), Fig. 6. Male, twenty-eight years old. No previous illnesses. Admitted complaining of pain in the right flank

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extending down the groin towards the bladder and occasionally down the lateral side of thigh. The pain was of six weeks' duration, more severe in the past twelve days. Onset with vomiting. Active flexion of the thigh increased the pain. There was burning on urination and increased frequency five to six times a night. Patient was having night sweats. Abdomen showed marked rigidity on the right side and marked tenderness in the right flank. An indefinite mass was palpable. The kidney could not be felt. Urine showed: specific gravity 1007, some pus, albumin one plus present.

Cystoscopy showed the bladder with moderate congestion. Number seven catheters were passed up both ureters easily and the functional test from the two sides was equal. A pyelography showed a mass below the kidney raising the kidney up to the spaces between the eleventh and twelfth dorsal vertebra two spaces high. The kidney was rotated on its axis antero-posteriorly. The lower calyx was elongated and partially obliterated by pressure from below.

Diagnosis of subrenal abscess was made, which was probably secondary to an appendicitis. Operation resulted in the drainage of the abscess, and although it extended down to the right fossa, the appendix could not be located extraperitoneally.

CASE VI.—*Retroperitoneal Sarcoma vs. Kidney.*—(No. 2297), Fig. 7. Male, thirty-three years old. Complaining of pain across the upper lumbar region and down both flanks and groins, worse on the left side, constant, seven weeks' duration; no colics. There had been night sweats with some productive cough. For the preceding two or three years he had noticed some lameness of the lumbar muscles and he had lost forty pounds in weight. There were no symptoms referable to the gastro-intestinal, cardiac, respiratory, neurological, nor skeletal systems. Urinary frequency was slightly increased.

Examination showed a well nourished, large framed man. Neck, small right goitre, inactive; supraclavicular glands on the left side the size of a hazelnut, not tender, firm and movable. Chest negative. Abdomen scaphoid, flanks equal, muscles relaxed. Liver not palpable. Spleen enlarged, just palpable, round edge. Left kidney palpable on inspiration somewhat tender, and a mass the size of an orange mesial to its lower pole but undistinguishable from it could be felt. This descended on inspiration with the kidney and was somewhat tender. Genital and rectal examinations negative. The laboratory findings showed: urine: specific gravity 1013, albumin a trace, no sugar, a few hyaline casts, pus cells, no blood.

Blood: White blood-cells, 10,700; haemoglobin, 70 per cent. Differential count: Polymorphonuclears, 74 per cent.; small mononuclears, 18 per cent.; large mononuclears, 3 per cent.; eosinophiles, 4 per cent.; transitory, 1 per cent.; urea nitrogen, 23.8; uric acid, 3.4; creatinine, 2.73; mgm. per 100 c.c.; Wassermann negative. P. S. P. 55 per cent. in three hours. The differentiation of this mass from the kidney was necessary.

Cystoscopy showed a normal bladder, an equal kidney function, negative cultures, and normal morphological elements. Pyelography showed a pushing of the left ureter away from its normal position outward, a normal left pelvis, a high left kidney and a normal position of the right ureter and kidney.

Diagnosis.—*Retroperitoneal sarcoma.* Exploratory operation on request revealed a small round-celled retroperitoneal sarcoma. The supraclavicular gland showed the same.



FIG. 8.—Coin placed over palpable mass (adrenal tumor). Renal pelvis low and distorted obviously the result of pressure and not destruction.

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Regarding masses above the kidney: A tumor arising from the adrenal shows several characteristic phenomena. The renal pedicle is the kidney's chief point of fixation and forms the axis upon which the kidney moves.

The renal axes are not parallel with the spine but oblique toward it at their upper poles at an angle of about 15° . The adrenals lie upon and between the upper renal poles and the spine so that a tumor mass arising from one



FIG. 9.—Pyelography-displacement of kidney by tumor between its upper pole and the spine.

of them pushes the upper pole away from the spine, thus straightening its axis parallel to that of the spine or divergent from it and also pushes the kidney down. It has been our experience in palpating such tumor masses that, when sufficiently palpable, one can clearly distinguish this obliquity of the tumor toward the spine, forming, as it were, an arch consisting of kidney below and merging into the tumor above which approaches or even reaches the spine. This we believe to be a characteristic physical sign of adrenal tumors. In one instance of bilateral adrenal tumors the two formed a com-

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plete arch. Such must be distinguished from horseshoe kidney inverted from its usual form.

The pyelographic evidence of such adrenal tumors follows this rationale.

a. The renal axis is parallel to or divergent from the spine.

b. The kidney is displaced down.

c. The upper renal calyces or pelvis are distorted or obliterated.

It has been our experience that extrarenal tumor more likely distorts or elongates the calyces by pressure and distortion of the kidney while an intra-renal tumor more likely obliterates or fragments the calyces.

CASE VII.—*Adrenal Tumor vs. Kidney.*—(No. 1751), Fig. 8. Male, fifty-seven years old. Complained of weakness with gastric distress and loss of appetite. During the preceding six months he had lost thirty pounds in weight. He complained of pain in the left flank extending down towards the groin, of a dull character.

Examination.—General nutrition poor, obviously anaemic and asthenic. In the left flank there could be palpated a mass about the size of an orange which had been diagnosed as splenic enlargement. It did not descend on inspiration, was somewhat tender, firm, and extended nearly to the iliac crest.

Blood count showed: Red blood-cells, 2,800,000; white blood-cells, 8000; polymorphonuclears, 60 per cent.; small mononuclears, 28 per cent.; large mononuclears, 10 per cent.; eosinophiles, 1 per cent.; transitories, 1 per cent.; haemoglobin, 85 per cent. Blood-pressure, 100/60.

In order to differentiate this mass from the kidney a cystoscopy and pyelography were done. The pyelography showed a markedly distorted renal pelvis lying in the left iliac fossa and an opaque mass above it clearly differentiating the kidney from an adrenal tumor. A clear space was apparent between the mass and the spleen. An exploratory operation proved the diagnosis and the impossibility of removing the growth. Death occurred some months later with autopsy.

CASE VIII.—*Hypernephroma vs. Kidney.*—(No. 2024), Figs. 9 and 10. Male, forty-nine years old. Complaint: gross haematuria for six weeks, periodic, no pain, slightly increased frequency of urination. (Examined for Doctor Hamann.)

Examination: Very well nourished, large framed individual. Palpation showed the right kidney descending low on inspiration, but did not seem enlarged. The mass was very deep-seated and it was impossible to feel the upper renal pole since what seemed to be the kidney did not descend sufficiently.

Cystoscopy.—Showed a functional capacity greater on the right than on the left side. Right haematuria. A pyelography (Fig. 9) showed the right kidney two spaces low, its



FIG. 10.—Specimen pyelographed after nephrectomy.

axis divergent from the spine above, a pressure partial obliteration of the upper calyx and a marked ureteral kink due to forcing down of the kidneys. (Fig. 10.) After nephrectomy and pyelography on the specimen the obliteration of the calyx is clear.

Pyelectasis. (Hydronephrosis).—Small dilations of the renal pelvis, unless associated with other disease, *e.g.*, acute pyelonephritis or perinephritis, are not liable to present a mass confusable with other conditions. However, the large dilations due to various etiological factors which we are not here discussing, occasionally furnish some problems of diagnosis. To inspection and palpation an indefinite tumor may be more or less obvious, the proof of which lies entirely with the passage of the ureteral catheter and the pyelography. A nervous hypersecretion may closely simulate an emptying of these cavities through a catheter. The old belief that they may empty rapidly through the ureter by straightening of a kink with renal colic is unfounded.

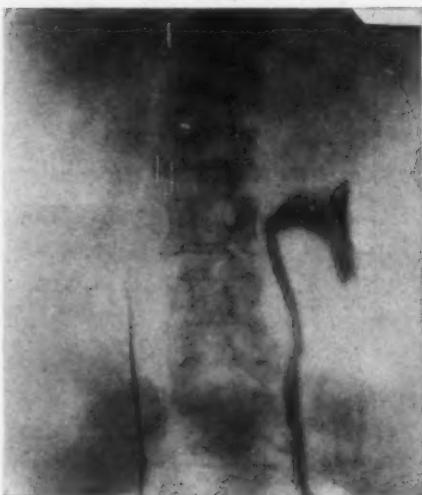


FIG. 11.—Gross renal tumor destroying entire kidney.

irregular intervals with attacks of pain, disappearance of the tumor and relief. This is obviously the ancient history of a large recurring hydronephrosis and has been so interpreted in her case.

It is strange how this poorly substantiated sequence has fixed itself upon the medical mind and literature resulting in false diagnosis. That it is impossible for a greatly dilated renal pelvis to empty itself so as to produce a large volume of urine in a short time is shown by the following facts. In such cases with a large catheter, *e.g.*, Nos. 7 or 8 in the ureter, it requires two or three or more hours to empty the sac if left to itself. One can press upon the flank and produce a spurt or continuous flow, but as soon as the tension is relieved resulting from a partial emptying of the sac, the flow reduces to a dribble increased more or less by respirations. Such a sac, holding 500 c.c., which is unusual, without a catheter in place, probably never empties more than to relieve the tension, after which the sac remains with a large residual. The conception that a kink having been relieved, the urine gushes through the ureter to the bladder, resulting in the sudden passage of a large volume, is truly unreasonable.

Such patients after colic, it is true, may pass large volume of urine, but so

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do many others without such renal dilation, and the volume of urine capable of being secreted by nervous patients or those in pain has been shown to be enormous. The pyelography in this case showed a normal pelvis.

III

A tumor arising within the kidney may displace the kidney up or down, but it always destroys or fragments one or more of the calyces or obliterates

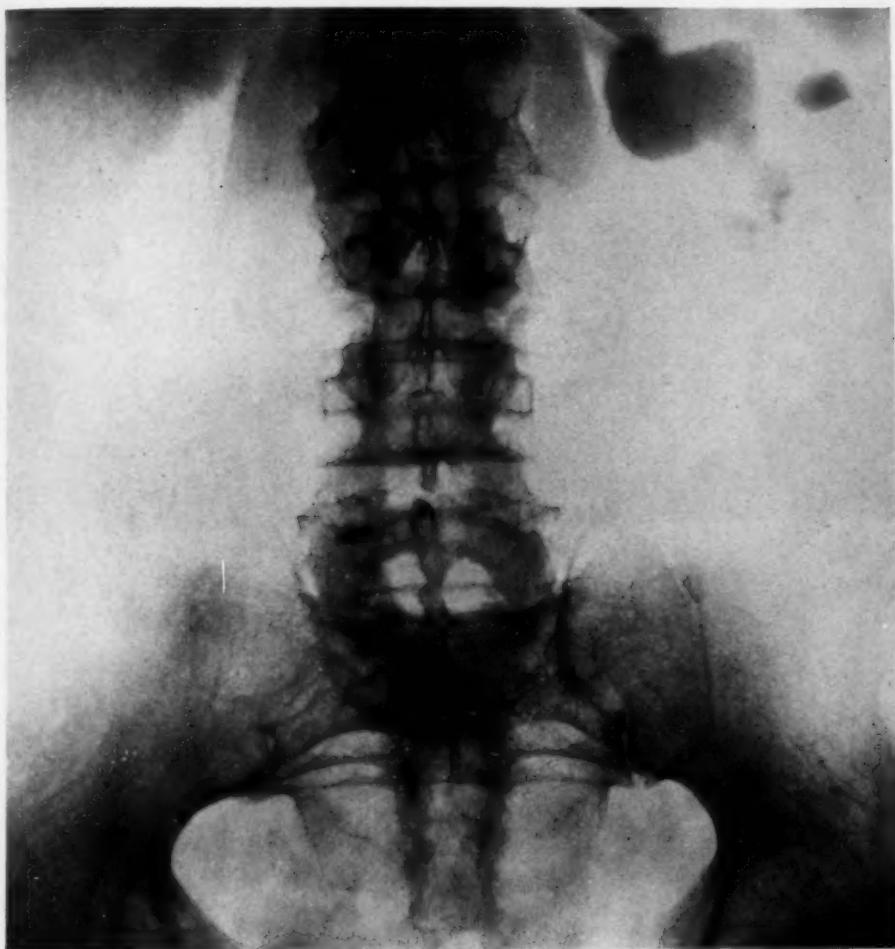


FIG. 12.—Left renal stones. Right ureteral stone (not clearly shown).

the entire pelvis. This is a well-known sign of renal tumor. The various conditions resulting in enlargement of the renal pelvis from obstructive pressure, *e.g.*, stone, stricture, kink of pressure from without, or ulceration, *e.g.*, tuberculosis, present their special characteristic features.

A tumor or abscess the size of a hazelnut in the parenchyma, not connecting with the pelvis, may result in a perfectly characteristic pyelography determining the presence of the mass but not necessarily its pathology. It is

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in such cases that a careful technic is especially necessary. A complete filling of the pelvis, or at least a complete lavaging of the entire pelvis in all its interstices with more solution than sufficient to fill the pelvis, is often essential. By so doing, a part of the solution runs down along the catheter to the bladder, as much as fifty c.c. being used in a pelvis with a capacity of perhaps twenty



FIG. 13.—Right pyelography after removal of ureteral stone shows a dilated pelvis and calyces not typical of back pressure; fragmentation of calyces; no pyonephrosis; tumor with the accompanying symptoms only possible evidence.

c.c. In renal tumor, the coin placed on the surface over the palpated tumor coincides with the pyelography if properly taken.

These cases of intra-renal tumor comprise the group of tumors most easily diagnosed by pyelography. Obliteration of the entire pelvis, or one or more calyces with haematuria, gives the diagnosis.

CASE X.—*Large Renal Tumor*.—(No. 2058), Fig. 11. Male, fifty years old. Complaint: gross haematuria. Cystoscopy showed haematuria to be from the left side.

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Pyelography showed an obliteration of all of the calyces, with the injected fluid filling the pelvis only. This was a typical picture of gross renal tumor substantiated by operation.

The cases of tumor causing the greatest difficulty in diagnosis are those presenting two pathological lesions, *e.g.*, stone and tumor or pyelactasis and tumor.

CASE XI.—*Stones and Tumor.*—(No. 2079), Figs. 12 and 13. Male, sixty-eight years old. Complained of gross painless haematuria for the past six months which had reduced his haemoglobin to 40 per cent. He had had no colics nor passed any calculi, but he had slightly increased frequency of urination, getting up two or three times a night.

Examination showed a fairly nourished individual, although anaemic and suggesting cachexia. Both kidneys were palpable but not tender. The right was the larger and felt firm. X-ray showed a large calculus in the left kidney, and a small one apparently obstructing the upper end of the right ureter. (Fig. 12). The blood was considered as being caused by stone irritation and came from the right side, as shown by cystoscopy instead of from the left side, which contained the larger stones.

The left urine, as obtained through a Garceau catheter, contained but 1.5 per cent. phthalein in fifteen minutes. This was considered the poorer kidney because of the low P. S. P. output and the large stones. His blood chemistry showed forty-two milligrams of urea nitrogen; four and three-tenths uric acid and 1.13 creatinin per hundred c.c. Because of the persistence of haematuria, it was impossible to determine the gross P. S. P. output and that of the right side.

It was determined that the blood was coming from the right side; that the right side was apparently the better kidney; and that there was a stone partially blocking this ureter. Anticipating a left nephrectomy, this stone was removed under local anaesthesia. The patient made a good recovery.

The haematuria, however, continued. His P. S. P. output from the left side had increased to seven and one-half per cent. in fifteen minutes. He was transfused. It was determined by pyelography (Fig. 13) that there was a tumor of the right kidney. This tumor therefore was the real cause of the hemorrhage. The kidney was therefore removed under local anaesthesia, after transfusion. The patient did well and left the hospital.

Four months after first seen, in spite of the presence of the calculus in his remaining left kidney the P. S. P. output in *three hours* was sixty-nine per cent. A local recurrence of his tumor occurred which proved to be a malignant papilloma, and the patient died some months later. In this case the diagnosis was confused by stones and impossible until the removal of one from the right ureter.

CASE XII.—*Stones and Tumor.*—(No. 667), Fig. 14. Male, fifty-five years old. He had suffered from pain in the upper left flank for about six years. Three years previously a surgeon had explored and concluded the tumor encountered as not removable.

Examination showed a poorly nourished man with a cocoanut-sized tumor in the left

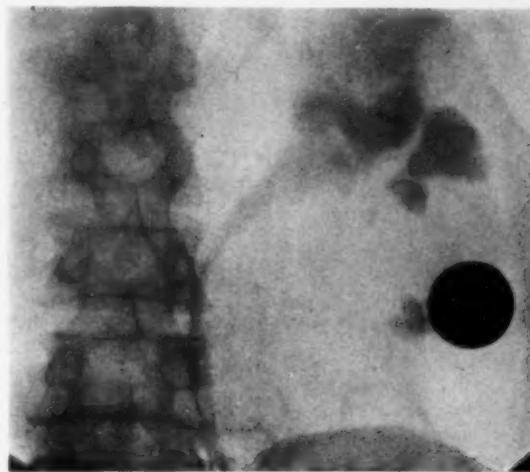


FIG. 14.—Dilation of pelvis and calyces not typical of back pressure only; fragmentation of calyces. Tumor with stones.

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flank movable with respiration; firm; fluctuant; smooth and tender. The colon on inflation was in front of the mass, the stomach to its right. Urine contained albumin one plus, pus and a few casts. Red blood-cells, 4,700,000; white blood-cells, 7200. Gross P. S. P., 40 per cent. in two hours. His prostate was large, firm, and he had 200 c.c. of residual urine.

The patient was transfused and the left kidney removed under gas anaesthesia through the abdominal route. He did well for two weeks, but as should have been expected his prostate was causing trouble, since he had some retention and the P. S. P. output had fallen to sixteen per cent. in two hours. A retention catheter resulted in improved excretion and another transfusion brought him to recovery.

SUMMARY

1. A coin placed over a palpated mass and a pyelography aids in the differentiation between intra- and extra-renal tumors.
2. Variation of the renal axes as shown by pyelography is often of great value in differentiating renal or extra-renal masses. The course of the ureter and its relation to the mass is suggestive.
3. Tumor without the kidney is more likely to change its axis and distort the pelvis or calyces.
4. Tumor within the kidney is more likely to obliterate or fragment the calyces.

ACUTE KNEE-JOINT INJURIES*

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IN A recent article on joint conditions Blake¹ called attention to the striking similarity in many of the factors involved in the surgery of the peritoneal, pleural and joint cavities.

In the development of abdominal surgery it was appreciation on the part of the surgeon that in the peritoneum he had an ally, rather than an enemy, that not only diminished fear of infection, but simplified its management when it had developed. The thoracic surgeon has developed a similar point of view toward the pleura. In the cavity of the knee-joint we have again a lining membrane which although different to some degree in histology and function, can nevertheless be regarded as also a strong barrier of defense against infection. Until the war, the opposite point of view was held, but since that time our increased confidence has brought more frequent surgical interference and different methods in dealing with suppuration and contamination.

The records of acute conditions in the knee-joint for the past five years on the First Surgical Division at Bellevue Hospital have been reviewed with the object of ascertaining to what extent this boldness has been justified.

The lesions have been divided into first, synovial membrane; second, ligaments; third, intra-articular fibro-cartilage; fourth, patella, fifth, intercondylar eminence.

1. *Synovial Membrane*.—Acute synovitis is a condition that accompanies many other injuries to the joint, and it is rarely safe to regard it as a simple clinical entity. The associated lesion, however, is often so slight that its presence is not clinically manifested. Where there is enough fluid to cause pain, aspiration as strongly advised by McWilliams² is safe and definitely indicated, but where fluid is moderate in amount we have been in the habit of applying several layers of cotton over which uniform pressure is maintained by long narrow strips of basswood, firmly bandaged. Active motion is instituted early, but walking must be delayed or exudation will recur. Early aspiration is particularly useful in haemarthrosis before much clotting has developed. Where a penetrating wound or laceration has extended into the joint cavity, immediate débridement with suture of the capsule without drainage was practiced in the only case that we had without bone involvement, and the joint remained free from infection. Another knee-joint which had been perforated by a bullet passing through the femur and lodging in the articular surface of the tibia resulted in perfect function in two weeks after débridement and primary suture, thus permitting early transfer to Sing Sing.

It is with the purulent exudates in the knee-joint that our methods of

* Read before the New York Surgical Society, January 27, 1926.

procedure have been most markedly altered. In civilian life, suppurative conditions of the knee-joint due to external trauma are very few as compared with the number seen during the war, and the Willems' method was published so late in the war that many of us have been left uncertain as to the result of its application in individual practice.

Our personal observations have been confined to ten cases exclusive of those which were late complications of extensive osteomyelitis. Of these ten, three were metastatic, four followed lacerations or penetrating wounds, one followed trauma without laceration, one resulted from the slipping into the joint of calipers applied for fractured femoral shaft, and one followed a post-operative infection of the curetted cavity of a giant-cell sarcoma in the head of the tibia. In six instances the organism was found to be *staphylococcus aureus*, in three *streptococcus*, and in one there was an anaerobic infection from the Welch bacillus which by the way made a complete recovery.

The treatment of these cases varied. One knee-joint which showed thick yellow *staphylococcus* pus, apparently metastatic in origin from infected tonsils, cleared up completely in about eight days after three aspirations without any open drainage, this proving a striking demonstration of the natural resistance of the joint if not traumatized or surgically insulted.

In the other nine a strenuous effort was made to observe the principles of Willems' ³ treatment, namely, wide lateral incisions, avoidance of all drainage material, and active ambulatory motion. In most of the patients varying modifications were forced upon us. For instance, where the infection had been introduced through a compound fracture of the patella, active motion could only be obtained after wiring the patella. This was done and was followed by osteomyelitis, failure of drainage, and amputation performed barely in time to prevent death from sepsis.

There was another instance of complete failure of Willems' treatment and final urgent amputation in the case of suppurative knee-joint following curettage of a giant-cell sarcoma.

Of the remaining cases, five ultimately obtained full function, one has 15° of motion, and one has complete ankylosis but a useful limb.

One of the cured cases was that in which the calipers had invaded and infected the joint. Because of the fractured femur active motion was impossible, and yet the joint cleared up under lateral incisions and irrigations with Dakin solution. As a rule when a suppurative arthritis is being maintained by a communicating bone lesion, amputation had best not be too long delayed. Insufficient drainage from lack of active motion or other cause will result in faulty milking out of the posterior bursae by the gastrocnemii and finally rupture and pocketing in the calf. This development is usually an indication of ultimate failure.

It is exceedingly difficult to obtain active coöperation from civilian patients, but when obtained early Willems' treatment gives results that form a dramatic contrast to the mournful progress offered by tube drainage, Mayo's operation or resection.

ACUTE KNEE-JOINT INJURIES

2. *Ligaments.*—The usual text-book description of the mechanics of the knee-joint tend to give a false impression of the relative importance of the various ligaments. We hold this view as a result of several dissections made on fresh knee-joints subsequent to amputation. The anterior crucial ligament is quoted as being a great factor in preventing hyperextension. Independently of the anterior crucial ligament, hyperextension is definitely limited by the lateral and posterior ligaments. This could be demonstrated by cutting only the anterior crucial ligament. Another misconception is as to the size and mobility of the external semilunar cartilage. It is loosely attached to the capsule and very firmly attached anteriorly and posteriorly to the crucial ligaments. It is wider than the internal, and has a very extensive rotary motion during flexion. The internal meniscus is very firmly attached to the capsule and has rather weak anterior and posterior attachments. The anterior attachment divides in two, to attach in front to the transverse ligament and just behind this to the anterior crucial ligament, and this is the origin of longitudinal fractures, as pointed out by Osgood and Surles.⁵ Also it was noted that these structures are attached in front and behind the spine and not to the spine itself, which therefore might be fractured without much involvement of the other structures. The capsule is particularly thin on the inner side of the patella, making this a favorable spot for aspiration.

With the knee in 30 degrees of flexion a sufficient period of immobilization instituted immediately should permit satisfactory healing of the crucial or lateral ligaments. (Henderson.⁴) We have in three instances attempted repair by suture of tears in the internal lateral ligament. The repair is made difficult by the fact that the torn ligament is often shredded, rather than cleanly ruptured, and also that the attachment to the tibia or femur may be torn off the bone. There was one instance of outward dislocation of the leg with a complete tear of the internal lateral ligament and a clean transverse tear of the anterior crucial ligament, as seen at operation. Open reduction and suture of the lateral ligament brought a perfectly functioning knee in two weeks, although no attempt was made to repair the anterior crucial ligament. It does not seem reasonable that any operation such as the Héy-Groves which is dependent on the transplantation of a fascial strip in the site of one or the other crucial ligaments could give any benefit other than that derived from the period of immobilization following operation. These methods are often spoken of but rarely if ever practiced. A good repair of the internal lateral ligament is a better substitute for the anterior crucial. A reefing of the internal lateral ligament with fascial transplant, if necessary, is indicated where insufficiently early immobilization has resulted in an unstable knee. There was one rupture of the quadriceps tendon and another of the ligamentum patellæ. Immediate suture in both these cases was followed by a very good result.

3. *Intra-articular Fibro-cartilage.*—In dislocation and fractures of the intra-articular fibro-cartilage, either internal or external, we have followed the usual practice of preliminary immobilization for six weeks or more in

TABLE I.
Acute Suppurative Arthritis of Knee joint

Case	Etiology	Organism	Treatment	Results
G. S., M., 43, No. 2835	Laceration into knee-joint, Oct. 7, 1922	B. Aerogenes capsu- latus	Willems' treatment	Dec. 16, 1922, crutches, March 20, 1923 function 80%. Sept. 28, 1923, perfect function.
P. C., M., 28, No. 4654	Traction calipers slipped in- to joint, Feb. 4, 1925	Staphylococcus aureus	Lateral incisions and irrigation with Dakin. No motion	Sept. 14, 1925, walking without limp. Ca- liper wounds discharging. Oct. 1, cured.
J. R., M., 32, No. 5276	Metastatic, probably tonsils, Aug. 24, 1925	Staphylococcus aureus	Attempted Willems' but pat- ient did not cooperate	Dec. 15, 1925, only 15 degrees of motion. Ankylosis probable.
A. S., M., 20, No. 3067	Metastatic, March 26, 1925	Staphylococcus aureus	Willems'. Poor cooperation	Long course with inability to cooperate on active motion. Oct. 6, 1925, com- plete ankylosis. Useful limb.
E. K., M., 35, No. 2641	Penetrating wound, June 9, 1922	Staphylococcus aureus	Attempted Willems'. Poor co- operation	Wounds ultimately healed with 90 to 165 degrees of motion. Developed 3 plus Wassermann and Charcot joint. Wears brace.
F. B., M., 35, No. 2791	Infected curvette giant- cell sarcoma, June 14, 1922	Streptococcus haemo- lyticus	Willems' failed. Amputation lower thigh	Amputation stump infected. Reamputa- tion necessary. Should have had pre- liminary disarticulation.
B. M., M., 15, No. 4580	Metastatic, Dec. 10, 1924	Staphylococcus aureus	Three aspirations. No open drainage	Sepsis subsided in 4 days under aspiration. Dec. 23, 1924, full function.
J. A., M., 29, No. 2372	Fell on knee, May 12, 1922. No laceration. Admitted, May 19, 1922	Streptococcus haemo- lyticus	Willems'	Dec. 19, 1922, full function. Moderate periartricular thickening.
R. B., M., 11, St. V. H.	Laceration into knee, Nov. 10, 1922	Staphylococcus aureus	Willems'. Walking same day	Walking in 24 hours. Squirting out pus. Wounds closed Feb. 1, 1923. Incomplete extension. June 1, 1923, full function.
W. S., M., 34, No. 3453	Compound fracture of pa- tella	Streptococcus haemo- lyticus	Patella wired and Willems' at- tempted. Failure. Amputa- tion	Prolonged convalescence due to infected amputation stump. Should have had preliminary disarticulation.

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the recent cases, in the hope that the lesion might heal. Most of our cases come to us, however, with a long history, many of them being city firemen. These lesions very rarely do heal without operation, and there would probably be a saving of time and less injury to the joint if the cartilage were excised on establishing the diagnosis. There is no question that recurrent locking and synovitis cause a permanent relaxation of joint structures. We have had fifteen operative cases, thirteen of the inner and two of the outer meniscus. There are three main types of trauma causing this injury; first, a fall on the foot with the knee in extension; second, a direct blow to the knee with the knee in flexion; third, twisting of the knee as in baseball or football, where there is a fall with the leg doubled under. One case gave no history of trauma at all. The pre-operative symptoms and operative findings are all indicated on the chart. Various means of approach were used, including split patella and dislocation of patella, but the simple lateral L-shaped incision always gave a satisfactory field. The external meniscus was in neither case detached anteriorly, although this was very common with the inner meniscus. There is no exposure that permits visualization of the posterior attachment. We had two cases of longitudinal fracture of the inner meniscus. In chronic cases a thickening and congestion of the ligamenta alaria and mucosa were frequently noted. In one case the suture of the loosened inner meniscus was followed by a satisfactory result as was also the removal of the deeper half of the longitudinally fractured inner meniscus in one of these instances. As a rule, however, the best results are those in which all of the accessible cartilage has been removed. If much of the posterior stump is left it will cause a distinct clicking sensation or bumping during convalescence.

Of the fifteen cases, eleven had normal function before discharge from the Follow-up Clinic. Of these eleven several went through a period of synovitis, instability and difficulty in going up and down stairs, but they were all free from symptoms for a considerable period before being closed. Of the remaining four, two were visited and were apparently without disability but did not report to clinic. Of the remaining two, one developed a post-operative phlebitis which delayed his recovery and subsequently developed a definite lateral mobility with instability of the knee. X-ray showed a calcareous deposit. The other was a bad result in which there was a persistent complaint of pain. The knee is free from fluid and shows no lateral mobility. Compensation in this case has never been settled. The most annoying post-operative complaint is the feeling of instability in the knee, but this ultimately disappears as the knee readjusts itself. The building up of the inner side of the shoe does not seem to be of any particular advantage. Our patients at Bellevue cannot afford to be laid up for a long period or with recurrent disability, and the immediate removal of all injured menisci would seem indicated. The X-ray gives very little, if any, diagnostic aid.

4. *Fracture of the Patella.*—There were twenty-five fractured patellæ, twenty-four simple and one compound. The compound case has been discussed under suppurative arthritis. Of the twenty-four simple fractures,

TABLE II.
Fractures and Dislocation of Intra-articular Fibro-cartilages

Case and date of admission	Date and type of trauma	Symptoms and signs	Operation	Results
W. R., M., 45 Apr. 13, 1920 No. 422	4 months previous. Fell on foot with knee in extension	Stiffness and swelling, no locking. Tender over inner meniscus	April 17, 1920, inner meniscus loose. Fracture of posterior 3rd. Meniscus excised	Post-operative phlebitis. Nov. 1925, bad result. Distinctly unstable knee. Tends to walk with knee stiff. X-ray shows calcaneous deposit.
H. J., F., 40 Oct. 27, 1920 No. 844	May 6, 1918, fell on knee with knee in flexion	Recurrent synovitis in spite of long immobilization. Knee gives way but never locked. Flexion 45 degrees. Inner meniscus tender	Nov. 1, 1920, meniscus loose. Not fractured. Meniscus sutured to capsule	Jan. 27, 1922, greatly relieved. Still has pain on climbing stairs. March 12, 1923, symptom free. Perfect function. Case closed.
G. T., M., 20 Mar. 7, 1921 No. 1139	Small piece of cartilage removed 3 yrs. before following injury at basket ball	Cured until one month ago. Repeated locking since. Small movable nodule outer side of joint	Mar. 12, 1921, fracture middle of ext. meniscus. Excision	July 5, 1921, perfect function. Case closed.
V. J., M., 18 Apr. 25, 1921 No. 1275	2 years ago, fell on foot with knee extended	Locking once a month. Slight external angulation. External cartilage tender, lateral mobility	Apr. 30, 1921, incomplete external meniscus, fracture, excision	June 21, 1921, slight lateral motion. Otherwise good function. Did not report again.
H. L., F., 24 June 13, 1921 No. 1418	15 months ago kicked in right knee	One month in plaster cast followed by repeated locking. Extension 135 degrees. Flexion, 90. Tender over inner cartilage	June 18, 1921, inner meniscus loose, not fractured. Inner meniscus excised	June, 1922, perfect function. Case closed.
W. S., M., 27 June 24, 1921 No. 1437	3 yrs. ago twisted playing baseball	No locking. Recurrent collapse of knee. Limitation of extension and flexion. Inner cartilage tender	July 3, 1921, split patella exposure. Anterior 3rd of cartilage loose in joint. Excision of inner meniscus	April 3, 1923, symptom free except for occasional click inflexion, probably due to post. stump of meniscus.
I. N., M., 29 Nov. 5, 1921 No. 1852	4 yrs. ago blown up by submarine. Cured after immobilization until 3 months ago	Repeated locking. Swelling. Full motion. Inner meniscus tender	Nov. 29, 1921, longitudinal fracture, inner fragment loose. Anterior two-thirds inner meniscus excised	Jan. 17, 1922. No objective symptoms but marked subjective instability. June, 1922, symptom free. Function, 100%.

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J. M., M., 43 Dec. 8, 1921 No. 1861	25 yrs. ago kicked at foot-ball and missed it. Disability recurred 1 year ago	Swelling, pain lateral mobility. Local tenderness and swelling over meniscus	June 6, 1922, occasional pain in outer side of knee. Jan. 16, 1923, symptom free. Function, 100%.
H. D., M., 35 Apr. 12, 1922 No. 2193	6 months ago. Swelling and pain. No trauma	Recurrent synovitis. Pain and catching in semiflexion. Limitation of motion. Inner meniscus tender	Apr. 15, 1922, inner meniscus loose anteriorly. Excision
F. F., M., 30 Jan. 19, 1923 No. 2924	2 yrs. ago fell on knee in semiflexion	Swelling, pain, recurrent locking. Tender over inner meniscus	Jan. 22, 1923, meniscus mobile. No fracture. Synovial fringes thickened. Excision of meniscus and fringes
J. G., M., 29 June 13, 1923 No. 3160	6 months ago leg twisted between 2 autos. 4 wks. in plaster cast	Repeated locking. In complete extension because of pain. Inner meniscus tender	June 16, 1923, inner meniscus fractured. Anterior half curled inside of joint. Excision
W. L., M., 16 June 13, 1923 No. 3385	4 1/2 mos. ago fell on knee	Swelling, pain, repeated locking. Fixed at 135 degrees inner meniscus tender	Oct. 1, 1923, inner meniscus attached at ends but free from capsule. Excision
I. L., F., 23 Nov. 26, 1923 No. 3794	2 days ago fell with knee twisted under her	Pain, swelling, tenderness and lump over inner meniscus	Dec. 1, 1923, anterior half of meniscus torn partially across and detached anteriorly. Excision
E. L., M., 37 Oct. 16, 1923 No. 3720	6 mos. ago fell in a hole on foot with knee semiflexed	Swelling, pain, recurrent locking. Tenderness and crepitus over inner meniscus	Oct. 27, 1923, inner meniscus detached anteriorly. Excision
D. K., M., 35 Jan. 16, 1925 No. 4675	2 1/2 yrs. ago, lifting barrel with knee flexed. Plaster cast 3 months	Repeated locking. Tender over inner meniscus. No swelling	Jan. 23, 1925, longitudinal fracture of inner meniscus. Excision of loosened inner portion
42		June 19, 1921, transverse fracture inner meniscus. Excision of inner meniscus	June 6, 1922, operated knee, 100%. Pain complained of in non-operated knee, May 20, 1924, both knees, 100%.
657		May 19, 1925, has complained of pain since operation. Examination negative. Compensation complex.	Sept. 18, 1923, pain and sense of instability. Complete motion. Lateral mobility, Oct., 1925, symptom free. Full duty as patrolman.
		Aug. 5, 1924, symptom free. Complete function.	May 22, 1924, failed to report in person but was seen working as waitress without apparent disability.
		Feb. 27, 1924, subjective instability. Objectively neg. March 17, 1925, symptom free. Function, 100%.	April 7, 1925, symptom free. Function 100%.

TABLE III.

Case	Date and type of injury	Date and type of operation	Date of discharge	Separation Ante-op.	Separation Post-op.	Union by X-ray	Follow-up
F. L., Male, Age 29	Apr. 23, 1921. Direct	Apr. 30, 1921. Suture of capsule	June 1, 1921	2.5 cm.	0	Bony	Discharged from clinic Sept. 1, 1921. Perfect.
L. R., Fem., Age 30	May 24, 1921. Indirect	June 3, 1921. Suture capsule	July 8, 1921	.5 cm.	0	No X-ray?	Nov. 20, 1923. Flexion only 90°, otherwise good function.
L. B., Male, Age 23	Dec. 5, 1921. Indirect	Dec. 9, 1921. Suture capsule	Jan. 19, 1922	2.5 cm. comminuted	1.5 cm.	Fibrous	Apr. 4, full function. X-ray shows absorption lower fragment.
G. M., Male, Age 51	Jan. 22, 1922. Direct	Jan. 31, 1922. Suture capsule	Mar. 5, 1922	3 cm.	0	Bony	June, 1922. Full function but effusion and crepitus present. Dec. 19, 1922, symptom free.
E. P., Male, Age 35	June 4, 1922. Direct	June 5, 1922. Suture capsule	June 29, 1922	3 cm.	0	No late X-ray	Dec. 5, 1922. Function 100% but fluid present, June 5, 1923, symptom free.
J. R., Male, Age 43	June 9, 1923. Direct	0	July 5, 1923	Barely any		No late X-ray	Aug. 20, 1923, symptom free.
W. S., Male, Age 34	Apr. 23, 1923. Compound	Amputation for sepsis	Sept., 1923	Compound	Amputa-tion		Artificial limb.
M. O., Fem., Age 56	Oct. 31, 1923. Direct	0	Nov. 27, 1923	Comminuted		Fibrous	Mar. 2, 1924. Only 30° of flexion. Ext. 17° weak.

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A. B., Male, Age 43	4168 May 3, 1924. Indirect	0 June 6, 1924 Incom- plete	Apr. 15, 1921 Mar. 22, 1921. Suture capsule	4 cm. 1 cm.	Fibrous	3 days after adm. was delivered. Op. under local. Follow-up May 17. Function 100%.	Sept. 10, 1924. Full duty as fireman.
M. R., Fem., Age 34	1204 Mar. 15, 1921. (Left side). Direct	0 June 6, 1924 Incom- plete	Mar. 1, 1922, 30° flexion	3 cm. 0	Fibrous	Oct. 3, 150% function. Has "creak". Apr., 1923, symptom free.	
Ditto. Opposite patella	Jan. 28, 1922. Right side. Indirect	0 June 6, 1924 Incom- plete	Dec. 10, 1920 Immed. motion	1 longitudinal fracture without sep.	O	Bony	Apr., 1921. Perfect.
E. H., Fem., Age 29	937 Sept. 5, 1920. Forcible flex- ion	0 June 6, 1924 Incom- plete	Sept. 30, 1920. Oct. 30, 1920. Suture and resut- ure	Fell and re- fractured. Oct. 30, 1920	1st time 3 cm. 2nd time 1 cm.	Fibrous	In spite of palpable separation ob- tained full function in 8 mos.
N. W., Fem., Age 52	888 Sept. 9, 1920. Direct	0 June 6, 1924 Incom- plete	Sept. 15, 1920. Fragment excised. Suture capsule	Oct. 10, 1920 4.5 cm. com- minated	O	Bony	Aug. 1, 1921. Full duty as fire chief.
J. O'H., Male, Age 36	790 Sept. 16, 1924. Direct	0 June 6, 1924 Incom- plete	Sept. 21, 1924. Suture capsule	Oct. 20, 1924 2.5 cm.	O	Bony	Dec. 29, 1924. Flexion still limited to right angle, no further visit.
S. M., Fem., Age 60	4173 Mar. 19, 1922. Direct	0 June 6, 1924 Incom- plete	Immediate motion	Apr. 12, 1922 0	O	?	July, 1922. Perfect.
J. M., Male, Age 35	2127 Aug. 20, 1922. Direct	0 June 6, 1924 Incom- plete	Aug. 24, 1922. Suture capsule	Sept. 24, 1922 5 cm. com- minated	2 cm.	Fibrous	Immediate result good but failed to return.

TABLE III.—(Continued.)

Case	Date and type of injury	Date and type of operation	Date of discharge	Separation Ante-op.	Separation Post-op.	Union by X-ray	Follow-up
1299 E. W., Fem., Age 32	July 7, 1924. Direct	July 10, 1924. Suture capsule	Aug. 10, 1924. Flexion 90°	5 cm.	2 cm.	Fibrous	Oct. 21. Lacks 10° of full ext. Failed to return again.
5174 G. Q., Male, Age 36	June 20, 1925. Direct	June 22, 1925. Suture capsule	July 20, 1925	4.5 cm.	.5 cm.	Fibrous	Oct. 21, 1925. Palpable gap but perfect function.
663 E. C., Male, Age 54	Jan. 1, 1925. Direct	Jan. 18, 1925. Suture capsule	Jan. 31, 1925	3.5 cm.	1 cm.		Lost. This patient had had an old fracture of opposite patella.
65 R. D., Male, Age 47	Oct. 4, 1919. Direct	O	Oct. 29, 1919	1 cm.		Bony ?	Firm union but on Sept. 3, 1920 was still limping.
660 453 A. B., Male, Age 44	Apr. 1, 1920. Direct	Apr. 5, 1920. Suture	Apr. 25, 1920	2.5 cm.	1 cm.	Fibrous	Full flexion and extension on May 1, but persistent "cracking". Sept., 1921, perfect.
415 T. M., Male, Age 48	Sept., 1919. Direct	Mar. 26, 1920. Ex- cision of old scar and suture	Apr. 30	2.5 cm.	1 cm.	Fibrous	Had disability and fluid before opera- tion. Mar. 22, 1921. No fluid, 90° of function.
J. M., Male, Age 21	Aug. 29, 1925. Direct	Sept. 1, 1925. Suture capsule	Sept. 21, 1925	2.5 cm.	1 cm.	?	Nov. 17, 1925. Moderate effusion. X-ray shows tilting. Flexion 90°. Not readjusted yet.

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seventeen were operated upon. Of the seven not operated upon, six had hardly any separation, and one refused operation. Sixteen sustained their fracture from direct violence, falling with knee in flexion. Only two gave a clean cut history of indirect violence. The others were contradictory. The procedure in all was about the same. The time of operation after injury varied, there usually being about a five-day interval. The exposure was made with a curved transverse incision with convexity upward. The lesion was repaired by chromic sutures for the lateral tears in the capsule thus approximating the fragments. Local anaesthesia was used in four cases and was very satisfactory. Lane technic was used as long as the patience of the individual operator permitted. As usually practiced on a general service, it is imperfect and a distinct handicap to the secure tying of sutures. All these cases were followed until complete function had been restored, with the exception of two cases which failed to report and one which reported only once, the immediate result being good. One of the cases that failed to report was a non-operative case.

Following operation immediate massage and active shrugging of the quadriceps was practiced. Passive and active motion of the joint were instituted in ten days. Patients were allowed on crutches in three weeks and were walking without support in one month. Active extension to 180° is almost always present at the end of two weeks, but flexion is markedly limited and should not be forced. In one case where passive motion was started on the fourth day the suture line opened up. Active motion is much safer than passive. At the time of operation the lower fragment is invariably found turned forward. When the two fragments are held together and sutures placed in the lateral tears, the posterior borders will very often stay approximated while a gap appears in the anterior borders. Subsequently there is slipping of the approximated posterior borders, and one or the other will form a sharp ridge projecting into the joint, thus interfering with the action of the three articular facets as they glide on the articular surface of the femur and this may be a cause of subsequent synovitis and irritation. It was present in several cases but always ultimately disappeared. In about half our cases we felt certain that only fibrous union took place, but this was associated with no interference of function, although it may subsequently increase the possibility of refracture. A firm suture of the lateral tears gives splendid results, but to increase the chance of bony union and to prevent inequality of approximation on the posterior surface a firmer suture of the bony fragments themselves could be easily accomplished by kangaroo tendon passed through holes that did not enter the joint surface.

Incision with convexity upward gave a satisfactory scar quite removed from the opening in the capsule and with less post-operative oedema.

The results are so strikingly satisfactory that there should be no question of the wisdom of operation in all fractures with separation. Several of our cases showed superficial infection, and post-operative oedema or temperature was the rule, indicating a possible reaction in the joint but no infection of the

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joint itself has taken place as a result of operation in the series of thirty-seven operations on the knee-joint, fifteen for cartilage, seventeen for fracture of patella, and five for torn ligaments. In view of the fact that asepsis was not always maintained, this would indicate a rather strong defensive power in the joint itself.

5. *Intercondylar Eminence*.—During this period there were treated four cases of simple fracture of the tibial spine. One at the end of nine months showed a perfect result. The other three after prolonged periods complain of recurrent synovitis and pain on standing, but none show abnormal mobility. The period of immobilization in thirty degrees of flexion averaged about six weeks and was associated with periodic active and passive motion.

Other fractures involving the articular end of the tibia were too numerous to present here, but apparently healing is as rapid and ultimate function as good as in non-articular fractures if the proper anatomical relations are restored. It is essential that avulsion or mushroom fractures be completely reduced and reduction maintained if necessary by nailing. We have one instance where perfect reduction was followed by recurrence due to failure to nail the fragments together.

Fixation of a comminuted intra-articular fracture with an ordinary nail was followed by early and complete restoration of function. The nail was removed without difficulty about a year later.

The broad title under which these rather loosely linked clinical findings have been presented would permit the inclusion for discussion of many other features. We have attempted, however, to cover only those problems for which our surgical service gave us clinical material.

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CUTANEOUS CARCINOMA OF THE LOWER EXTREMITIES*

A STUDY OF CASES AT THE BARNES AND THE BARNARD FREE SKIN
AND CANCER HOSPITALS OF ST. LOUIS, MO.

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THE aim of this paper is not to present any solution to any of the various aspects of the cancer problem, but to discuss the variety of carcinomata of the lower extremities and the course taken by this disease arising in this region of the body. The material was obtained at the Barnes and the Barnard Free Skin and Cancer Hospitals.

Frequency.—Of all the carcinomata found in the different regions of the body, those of the lower extremities are the most rare. Broders reports 12 cases of carcinoma of the lower extremities out of 2000 admitted to the Mayo Clinic between November 1, 1904, and July 22, 1915. The writer has obtained 7 cases out of 723 cases of carcinoma now (December 1, 1923) recorded in the Barnes Hospital, and 10 cases out of 6043 cases of carcinoma recorded at the Barnard Free Skin and Cancer Hospital. (See Table I.)

TABLE I
Frequency of Cutaneous Carcinoma of the Lower Extremities

Period (yrs.)	Total no. ca. cases	Ca. of lower extremities	Percentage
Mayo Clinic	10.5	2000	.6
Barnes Hospital	11.0	723	1.0
B. F. S. and C. Hospital...	18.0	6043	.2

Pathology.—It is claimed by Bloodgood that there are only two important types of cutaneous carcinoma; namely, the squamous-cell carcinoma and the basal-cell carcinoma or rodent ulcer. The mode of development, as well as the gross and microscopic findings in each variety, will now be dealt with.

The squamous-cell carcinoma is a growth of squamous epithelium of the skin. This growth leads to a thickening of the epidermis and an invasion of the underlying structures. This tumor growth has its origin in the Malpighian layer. On account of the intercellular spines or prickles which the cells of this tumor show, it is called a prickle-cell carcinoma. The primary growth leads to masses of cells. Growth continues at the edge of these masses, the central cells undergo cornification or pearl formation.

Many of these neoplasms develop in old or long-standing ulcer or in scars of old burns. Those occurring on scars of burns are called Marjolin's ulcers. When a chronic ulcer undergoes malignancy, the malignant change starts at

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any point at the edge of the ulcer and is first manifested by the induration and thickening of the edges. This thickening is due to the overgrowth of the epithelial cells and to an increase of the connective-tissue cells. The growing epithelium spreads in all directions to involve also the cutaneous tissue outside the ulcer. The edges and bases of these ulcers become nodular and irregular in outline. The floor is irregular and is covered by necrotic cancerous tissue. This necrotic tissue is gray and opaque. The ulcer is hard and bleeds readily. The ulcer generally has a foul odor and may be very painful.

Basal-cell carcinoma (rodent ulcer).—After the diagnosis of carcinoma has been made on an ulcer of the lower extremities by the history and gross appearance of the lesion, it is almost impossible to ascertain in all the cases without the aid of the microscope whether the case is one of squamous-cell carcinoma or basal-cell carcinoma. However, many of the rodent ulcers have a few things in common; namely, (a) the margin is raised, firm, rolled, and has a glossy or mother-of-pearl appearance; (b) the progress is slow (five to ten years is a common



FIG. 1.—Case III. Squamous-cell carcinoma of the foot.

duration); (c) the lymphatic glands are, as a rule, not involved; (d) the ulcer is shallow and dry, sometimes covered by a crust and bleeds readily when rubbed; (e) pain is absent except in the later stages. Of these, the slow progress, the translucency of the border, and the non-involvement of the lymphatic glands differentiate rodent ulcer from squamous-cell carcinoma of the prickle-cell type.

Microscopically, rodent ulcers have no epithelial pearls. The cells are round (Fig. 2b), polygonal, or even spindle in shape (Fig. 3). The cell columns are not always sharply defined from the surrounding stroma.

Distribution.—Either of these two types of cutaneous carcinoma can occur

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on cutaneous or muco-cutaneous surfaces, but collected data reveal the fact that they are most common in the region from the neck up and rare on the trunk and extremities. (See Table II.)

TABLE II
Distribution of Squamous- and Basal-cell Carcinoma

Barnes Hospital (squamous- and basal-cell carcinoma)		Percentage
Total number of cases	361	
Neck and up	280	78
Trunk	56	15
Upper extremities	18	5
Lower extremities	7	2

Barnard Free Skin and Cancer Hospital (squamous- and basal-cell carcinoma)		Percentage
Total number of cases	1105	
Neck and up	959	86
Trunk	39	4
Upper extremities	97	9
Lower extremities	10	1

Mayo Clinic and Johns Hopkins Hospital		Total
(Mayo Clinic) (Squam. cell)	(J.H.H.) (Basal cell)	
Total number of cases	256	434
Neck and up	200	362
Trunk	12	18
Upper extremities	32	36
Lower extremities	12	18

Etiology.—(a) Sex. Cutaneous carcinomata in general are more common in males than in females. Broders states that his 256 cases show a ratio of 4:1. The writer in his series has 12 males and 5 females. If injury, which is to be discussed later on, is an important factor in the etiology of carcinoma as is universally believed, then it is perfectly natural to expect that this malady would be more common in men, whose legs are more subject to injury than in women.

(b) Age.—Almost every writer says that cancer is rare or seldom seen before forty, or that cancer is a disease of advanced years. The writer does not wish to contradict these statements, but wants to draw the attention of the readers to the fact that his series includes four cases aged twenty, thirty, thirty-one, and thirty-two, respectively; thus 4 out of 17 are below the cancer age as it is given in text-books. Is it not safe to say that these four cases are too many to be branded "atypical"? With these cases in mind one is tempted to assume that carcinoma arising from injuries, especially those on the legs—and injuries are very common on the legs—are not very rare in persons under forty as they are commonly supposed. It seems as though malignancy arising from injuries does not show much respect for youth. It is always a good thing to suspect cancer, even if the patient is still around thirty.

(c) Trauma.—In glancing at Table III, it will be noticed that trauma

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TABLE III.
Synopsis of Cases

Case	Age—Sex Path. No.	Location of lesion	Size of lesion	Duration of ulceration	Probable cause	Wassermann	Glandular involvement (inguinal)	Osteomyelitis of tibia	Clinic diag.	Micros. diag.	Treatment	Result when discharged	Present status	
1 1935	32—M	Lt. leg	6 x 4 cm.	1 yr.	Trauma	Neg.	Enlarged				Amputation	Improved		Uncertain.
2 2471	58—M	Rt. leg, post. and lat. surface of thigh, knee and calf	36 x 10 cm.	56 yr.	Burn	Neg.	None				Amputation	Improved		Uncertain.
3 4568	31—M	Rt. foot	Entire foot	11 yr.	Trauma	None					Amputation	Improved		Living and well.
4 4896	56—M	Lt. leg below knee	5 x 8 cm.	3 mo.	Trauma	+++	Enlarged				Excision in Salsvaran	Improved		Uncertain.
5 6310	60—M	Lt. popliteal space	3 x 3 cm.	30 yr.	Burn	Neg.	None	Contracture popliteal space			Excision of cicatrix	Improved		Uncertain.
6 6856	59—M	Lt. leg	3 x 5 cm.	1 yr.							Basal cell ca.	X-ray	Ulcer healed	Uncertain.
7 6885	30—M	Lt. tibia	6 x 8 cm.	25 yr.				Fracture lt. femur, osteomyelitis			Squamous cell ca. (prickle cell type)	X-ray, later amputation	Improved	Still under treatment.

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8	P-55	20-F	Lt. thigh	Multiple	1 yr.	9 yr.	Burn	None												
9	None	75-F	Rt. thigh	10 x 10 cm.	3 yr.			None												
10	P-721	62-M	Lt. ingui- nal flexure	7 x 7 cm.	1 yr.			None												
11	None	53-M	Lt. foot	Entire foot	30 yr.			Enlarged and suppurating												
12	14-114	63-M	Rt. foot	Multiple ul- cers and nodules	1 yr.	29 yr.	Burn (hot grease)	None	Enlarged but not meta- static											
13	20-47	54-M	Rt. leg and thigh	35 x 6 cm.	5 yr.	47 yr.	Burn	None	Enlarged on rt.											
14	21-353	87-F	Rt. heel	4 x 3 cm.				None	Enlarged on rt.											
15	22-180	51-M	Lt. leg and thigh	2 x 2 cm.	4 yr.	16 yr.	Psoriasis	None												
16	22-213	77-F	Ball of big toe on rt.	1.5 x 2.5 cm.	8 mo.	6 yr.	Trauma	None												
17	23-49	67-F	Lt. leg	30 x 15 cm.	1 yr.	51 yr.	Chronic ulcer- ation	Neg.	Enlarged both sides	Varicose ulcers rt. leg										
18*	7575	52-M	Rt. leg	8 x 10 cm.	1 yr.	14 yr.	Trauma	None	Enlarged both sides	Varicose veins on both legs, metasta- tic nod- ules in liver										

* See supplement.

plays a leading rôle in the etiology of these carcinomata. In some of these cases malignant growth started not very long after the injury, and in others years have elapsed before any manifestation of malignancy made its first appearance. In other words, the period of time elapsing between the infliction of the injury and the first appearance of the malignancy varies from a few months to years.

(d) Scars.—Another predisposing factor which plays an important rôle in the etiology of cancer is the scar in the site of old trauma brought about

by burns. It is a common observation among surgeons that scars left by burns are very liable to become the seat of squamous-cell carcinoma, especially those situated on the lower extremities where they are more common than on the upper extremities or trunk. The malignant growth starts at the junction of the cutaneous tissue and the scar tissue. The other peculiar thing about burns on the lower extremities is that after



FIG. 2a.—Case IV. Basal-cell carcinoma (rodent ulcer) of the leg.

the amputation of the limb for carcinoma, there is a tendency for the disease to recur at the stump. The five cases in the series give a history of burns of many years ago. In one of these a simple ulcer had persisted for fifty-six years. He has no history of syphilis and gives a negative Wassermann. The four others give a history of primary healing of the burned area. Later, after several years, this area broke down. The second lesions failed to heal. Broders has shown that one-fifth of his cases had arisen from scars of burns, and he, therefore, suggests that scars should be watched for a possibility of malignancy. These cases, together with those reported by others, are enough to convince one that old scars have a decided tendency to ulcerate, that the ulceration refuses to heal, and finally leads to carcinomatous growth.

(e) Syphilis.—As far back as 1843, it was argued by many observers—and with convincing evidence—that syphilis is a strong predisposing factor for carcinoma. Unfortunately not all the cases in the writer's series have had Wassermann tests; several of these were treated before the Wassermann test was in general use. Of the seven that had a Wassermann test only one gave a positive reaction. This particular case gave a history of trauma at the site of the cancerous growth. Either the trauma or the syphilis might have brought about the malignancy. However, it is of interest to note here in passing that a number of observers, among whom are Fournier and

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Poirier, believe that from 85 to 95 per cent. of the cases with syphilitic lesions in different parts of the body develop carcinoma.

(f) Varicose Veins and Varicose Ulcers.—It is a question what part varicose veins and varicose ulcers play in the etiology of carcinoma. It is, however, generally accepted that chronic ulceration is an important factor in the causation of carcinoma. In the lower extremities, the most common cause of ulceration is varicose veins. In going over the histories of cases of varicose ulcer at the Barnes and the Barnard Free Skin and Cancer Hospitals, the writer has found 310 cases, all of which were practically within the cancer age and with a chronicity of from six months to thirty-five years. He found that only one had become malignant. These figures, together with the greater predominance of cutaneous carcinoma in men than in women (about 4:1) and the greater predominance of varicose veins and varicose ulcers in women than in men (4:1 according to White, and 3:2 in the writer's 310 cases of varicose veins and varicose ulcers), seem to show that varicose veins and varicose ulcers do not play a very important part in the causation of carcinoma of the lower extremities.

Metastasis.—Cutaneous carcinoma of the lower extremities in particular, and cutaneous carcinoma of other regions in general, metastasize rather late. Many of them do not show any sign of metastasis at all in the inguinal glands at the time the patient applies for treatment. This slow or late metastasis is explained by the fact that the edges of the ulcer undergo thickening and induration which are believed to squeeze the lumen of the lymphatic vessels. This prevents the flow of lymph which ordinarily carries the cancer cells. In the cases here presented only two had the inguinal glands excised for some reason or other. Our only reason for suspecting metastasis in some of them is the presence of the enlarged inguinal glands. The enlargements of the glands may have been due to other causes. As to how long these inguinal

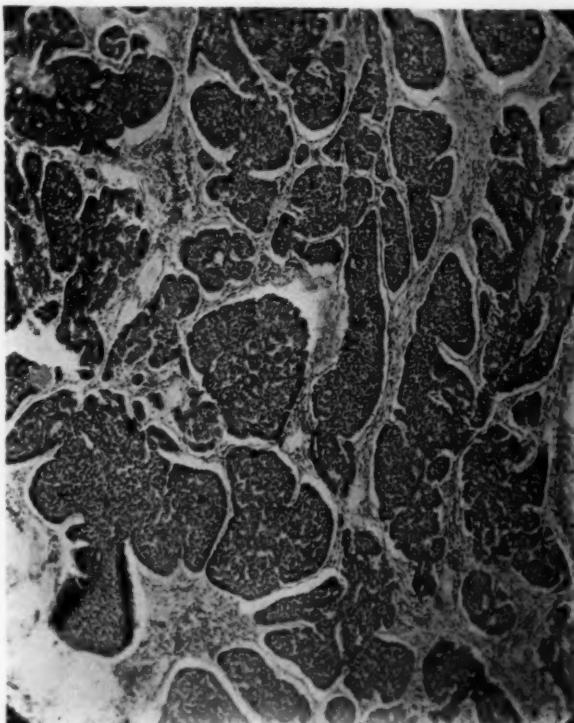


FIG. 2b.—Case IV. Basal-cell carcinoma (rodent ulcer). Microscopic section of specimen shown in Fig. 2a. The cells are mostly spherical in shape.

glands have become enlarged is a difficult matter to decide, for the clinical clerk seldom, if ever, asks the patient that question. Answers given by patients are also of doubtful importance. The fact remains, however, that some of these cutaneous carcinomata metastasize rather late for the inguinal glands in some of them are not even palpable even after the disease had grown so extensively as to justify the amputation of the limb. This fact of late metastasis, therefore, suggests that early excision might be quite sufficient to effect a cure, or at least, to avoid metastasis.

Some observers have proved experimentally that metastasis in distant organs has occurred in animals simply by employing unnecessary handling or massage, during the operation. That unnecessary manipulation during the operation has caused metastasis is a well-known fact. Therefore, it behooves the surgeon to be as gentle as possible with the affected organ.

Treatment.—The choice of treatment of carcinoma of the lower extremities, like that of the other regions, is chiefly determined by the extent of the malignancy at the



FIG. 3.—Case VI. Basal-cell carcinoma (rodent ulcer). Microscopic section of basal-cell carcinoma of the leg. Many of the epithelial cells are spindle in shape (compare with Fig. 2b). Note the palisade-like arrangement of the border cells.

time the patient applies for relief, the nature of the growth (whether basal cells or squamous cells), and also by one's personal choice based on his experience with his favorite method or methods. In a short paper like this there is no place for the discussion of all the different methods of treatment, together with their merits and demerits, though each may have its place under varying conditions. It might be of interest, however, to mention a few of these methods that have the most advocates and whose advantages are least questioned.

Amputation is the first choice under a number of existing conditions. If the malignant area is large, amputation is preferred and the results are satisfactory. This method of treatment is always called for in those cases which are associated with gangrene, with elephantiasis, and in large and incurable ulcerations that extend around the limb. These conditions usually mean that

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the limb is of no use to the patient. If, however, the growth is of the basal-cell type and is relatively small, less radical measures are often successful because of the more benign character of the lesion.

Excision with the cold knife or the electric cautery are, I believe, the most commonly employed. But the electric cautery is the more preferred of the two. It destroys avenues of escape for tumor cells to distant regions.

The Röntgen-ray, because of its success where other modes of treatment have failed, has rallied many supporters to its standards, most of whom are X-ray experts. But in the hands of a novice the danger of X-ray therapy lies in the resulting burn which almost never heals. The burn is exquisitely painful, and has a special predisposition to carcinoma. Radium also has been often used successfully, especially in those cases which are of the basal-cell type. But, similarly, caution must be exercised with regard to the production of a burn.

Electrocoagulation Method.—This method of treatment is advocated on the ground that it prevents reinoculation or extension of the disease. It is employed as an adjuvant to the other aforesaid modes of treatment.

The Combined Methods.—It is fully recognized that none of the above-mentioned methods may be applicable to all cases of carcinoma. On this ground, Bryant and others advocate that radium and surgery will accomplish the best results. In this case radium is to be applied before and after the operation. The idea with the former is to render the cancerous cells temporarily inert during the operation, and the latter, to destroy or encapsulate the cancerous cells left behind. The advocates of X-ray, on the other hand, also claim that the greatest good is accomplished by the combined use of surgery and the X-ray. The arguments offered in support of either of these combined methods are plausible enough, but Pfahler was not satisfied with the results obtained by either of these combined methods. His idea was to "finish" those malignant cells which for unknown reasons were recrudescent

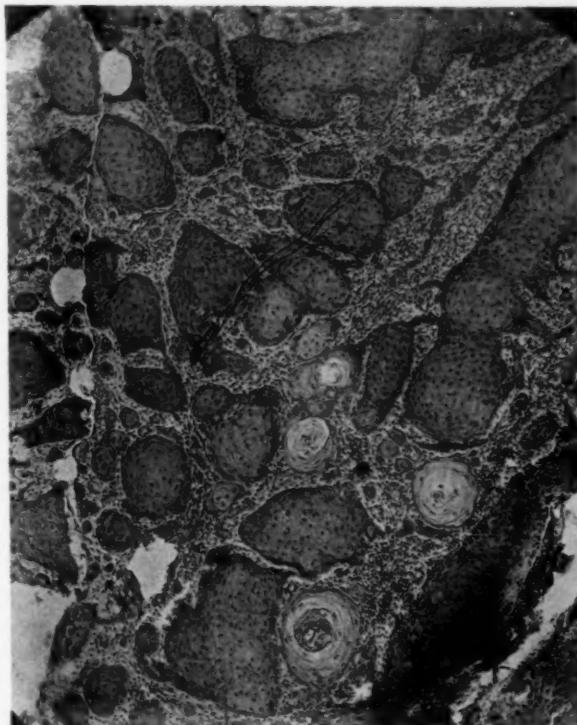


FIG. 4.—Case VII. Microscopic section of a typical squamous-cell carcinoma with epithelial pearls.

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after either of the above methods. He, therefore, suggested that perhaps the best results could be obtained by the combination of the electric cautery, radium, X-ray, and electrocoagulation methods. He, with many others, claims that these combined methods accomplish the greatest good and the lowest mortality.

REPORT OF CASES (BARNES HOSPITAL)†

CASE I.—No. 3791, E. T., male, thirty-two years old, well developed, muscular, and weighed 151 pounds. He entered the hospital on February 5, 1917, for an ulcer on the left leg below the knee. When nine years old he was hit on the hip with a clod of frozen dirt. A lump appeared which later was followed by other lumps on the leg below the knee. A physician opened the lumps on the hip and leg and bone fragments were removed. They healed. In 1911, he fell off a wagon and bruised his hip and leg again and soon after an abscess developed at the hip. Bone fragments were again removed from the hip and leg. Healing followed and the wound remained healed until 1916, when he had another injury on the shin. The wound never healed since. Three months previous to admission he suffered another injury. On examination the inguinal glands were found enlarged and firm. The ulcer was 6 x 4 cm. The edges were hard and tender but were not irregular. The base had a cauliflower appearance, and had a deep green foul discharge. X-ray examination showed osteomyelitis of the tibia. He had a negative Wassermann reaction. The left leg was amputated at the junction of the upper and middle thirds. He had improved when discharged, March 13, 1917. Efforts to locate him in order to ascertain subsequent results failed.

Pathology.—The section of the ulcer shows isolated masses of different sizes and shapes made up of squamous epithelium surrounded by scanty amount of connective tissue and cellular infiltration mostly round cells and a few polymorphonuclear leucocytes. The epithelial cells at the border of these masses have a narrower protoplasm than those at or near the centre, and the nuclei stain more deeply with haematoxylin. The nuclei assume a variety of shapes. Some are round, others are oval, and a very few approach a spindle shape. The cells are uniform in size and regular in shape. The border cells make up from two to six layers but mostly from two to four. The oval-shaped nuclei have a transverse diameter much less than the diameter of the round ones. The inter-cellular spaces are more distinct near the border than at the centre. Epithelial pearls are present in the centre of the masses. The nuclei are fewer per unit area and do not stain so sharply. Diagnosis, squamous-cell carcinoma (prickle-cell type).

CASE II.—No. 5321, J. C. J., male, fifty-eight years old, entered the hospital, March 3, 1918, for a sore on the right leg. He received a burn when two years old. Since then it never healed in spite of the efforts of two doctors. At times the sore was small, but at other times it was extensive. The ulcer had a very large area covering the posterior and lateral surfaces of the right thigh, knee, and calf. The edges were indurated, raised, and irregular. The base was red and filled with unhealthy granulation tissue which gave it a nodular appearance. A slight amount of foul discharge was present. The left leg showed a slight degree of muscular atrophy. The right leg was flexed to the knee and this was the most comfortable position for the patient. In 1916-1918, the sore had spread so rapidly that it had grown from about one-half the length of his palm (9-10 cm.) to about 36 cm. in length. At the time he applied for treatment the ulcer extended from the junction of the middle and upper thirds of the thigh to the middle of the calf. He had been treated with salves. He had a negative Wassermann

† It is unfortunate that so few of the patients could be traced later in order to get information about their condition at the time of the preparation of this paper. It would seem as if there must be a particular tendency for patients with these lesions to belong to the "floating" class of the population.

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reaction. The inguinal glands were palpable but not much enlarged. An amputation was performed through the middle third of the thigh. He was much improved when discharged, May 30, 1918. It has not been possible to locate him or to hear of his condition since his discharge.

Pathology.—The microscopic section shows invasive growths of epithelial cells arranged in masses which vary in size and shape. These are surrounded by connective tissue and leucocytes. The nuclei of the border cells stain deeply with haematoxylin. They are round, oval, or spindle in shape. In the centre of these masses the cells are less crowded, and the nuclei exhibit no uniformity of staining quality. Some stain deeply while others stain faintly. Characteristic pearl formations are present. Many of the cells are undergoing mitotic changes. Diagnosis, squamous-cell carcinoma (prickle-cell type).

CASE III.—No. 10,991, C. M. A., male, thirty-one years old, a mechanic by trade, entered the hospital, July 28, 1921, for a sore on the right foot. On August 26, 1900, he was run over by a truck and his big toe of the right foot was cut off and the rest of the foot was skinned. The toe was amputated at the City Hospital but the wound did not heal completely before he left the hospital. This wound was later treated by a physician. Partial healing followed but the remaining toes were in an abnormal position (Fig. 1). He was unable to walk for four years. The skin did not completely heal. In 1910, he was injured again on the right foot. Ulceration began and did not heal since. The duration of the ulcer was eleven years. The base of the ulcer was about 1.5 cm. thick on section and cut with difficulty. The history does not state the presence of enlarged glands. No Wassermann test was made on this patient. An amputation was performed through the middle third of the right leg on July 29, 1921. He was discharged on August 12, 1921. He is now (December, 1923) living and well.

Pathology.—The microscopic section shows invasive growth of the squamous epithelial cells forming columns chiefly characterized by numerous epithelial pearls. Many of these epithelial columns show signs of activity. Mitoses are seen in their border cells. Most of the epithelial pearls have undergone partial or complete necrosis. The active cells stain blue with haematoxylin and the necrotic areas stain pink. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE IV.—No. 11,658, J. S., male, fifty-six years old, a miner by occupation, entered the hospital on November 6, 1921, for an ulcer on the left leg just below the knee-joint

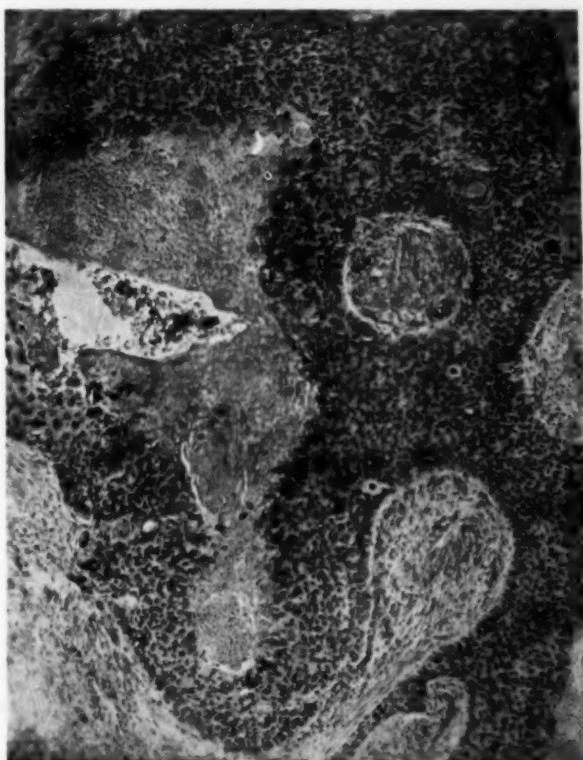


FIG. 5.—Case X. Microscopic section of squamous-cell carcinoma showing the large typical epithelial cells and the absence of epithelial pearls. (Compare with Fig. 4.)

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and situated latero-posteriorly. Six months before coming to the hospital he was struck on the site of the present ulcer with a piece of coal. The skin was bruised. There was no immediate swelling but the area was slightly tender. He applied salves. Two months later he noticed a slight swelling of the size of a peanut at the site of the old trauma. The tumor grew and three months later it reached the size of a walnut (Fig. 2a). Ulceration began to take place then. There was a moderate amount of dirty, greenish-yellowish

discharge and slight bleeding at times. The centre showed necrosis. He suffered no pain. The tumor (5×8 cm.) was excised, November 29, 1921. He refused excision of the enlarged inguinal glands. He had a four plus Wassermann and was given salvarsan treatment. He was much improved when discharged, December 8, 1921. He did not report for further treatment. He has not been heard of since.

Pathology.—The mass had the shape of a hemisphere measuring $7 \times 6 \times 4$ cm. It contained two ulcers on its outer surface. Microscopically, the section (Fig. 2b) shows irregular epithelial-cell masses surrounded by dense connective tissue. The cells in these masses stain uniformly blue with haematoxylin. There is no central pearl formation. The masses are composed entirely of basal cells. This is a picture of a typical basal-cell carcinoma. All the larger masses show central necrosis. In a few, the necrotic areas have liquefied in part. Cysts are thus formed. Diagnosis: basal-cell carcinoma.



FIG. 6.—Case XIII. Squamous-cell carcinoma of the posterior aspect of the thigh, knee and calf.

CASE V.—No. 14,700, J. J. H., male, sixty years old, weighed 220 pounds, entered the hospital, March 3, 1923, for an ulcer on the left leg. Thirty years previous to admission he was burned in an oil explosion. The back and legs were burned but the left leg was worse than the right. Soon after, the left leg showed contracture at the left popliteal space and since then he experienced an inability to extend the left leg. There was no pain present until six months later. Efforts to extend the limb oftentimes resulted in the cracking of the scar tissue. At the time he reported for treatment an ulcer of the size of a fifty-cent piece (3×3 cm.) was found at the centre of the scar tissue. This ulcer started as a small red papule as large as a dime (1.5×1.5 cm.). This finally broke down and resulted in ulceration which gradually spread until it reached its present size. The ulcer was

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situated just below the popliteal space. The edges were sharply defined, suggestive of syphilis, but the Wassermann test was negative. The history did not mention the presence of enlarged glands. The cicatrix was excised and he had improved. He was discharged on May 7, 1923. He has not been heard of since.

Pathology.—The section shows irregular masses of epithelial cells surrounded by connective tissue and cellular infiltration. The cells at the border of these masses are round or oval. Their nuclei stain deeply with haematoxylin. The centre cells show signs of degeneration. Epithelial pearls are present. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE VI.—No. B2645, J. T. G., male, fifty-nine years old, reported at the dispensary, September 23, 1923, for a sore on the left leg which he had had for over a year. It was located at the middle of the left leg and measured 3 x 5 cm. The base was irregular and slightly translucent. He had a negative Wassermann. He had been treated with X-ray and the ulcer has healed.

Pathology.—Microscopically, the section (Fig. 3) shows strands of epithelial cells which are not very well differentiated extending into the deeper tissues. Here and there are areas of necrosis. No epithelial pearls are present. The nuclei are deeply stained with haematoxylin and the outline of the individual cells are not easily made out because of the density of the cell masses. The cells are mostly spindle in shape. Diagnosis: basal-cell carcinoma.



FIG. 7.—Case XV. Squamous-cell carcinoma of the leg arising secondarily to psoriasis. Note the scaly character of the surrounding skin.

CASE VII.—No. B3365, W. T. U., male, thirty years old, reported at the dispensary, September 27, 1923, for an ulcer over the left tibia. Twenty-five years previous to admission he had a fracture of the left femur. The left leg was placed in a plaster cast for six weeks. Shortly after the removal of the cast the left leg became swollen and an operation was performed for an acute osteomyelitis. Drainage sinuses persisted. At the time he came for treatment there was a granulating ulcer 6 x 8 cm. over the left tibia on the medial surface. It contained numerous papillomatous tumor growths up to 2 cm. in diameter over the surface. It bled readily. The condition suggested carcinomatous growths superimposed over an old chronic inflammatory condition. There were numerous scars marking the site of old sinuses over the leg. These indicated an old osteomyelitis. He had lost in weight from 150 to 135 pounds. The right inguinal glands were enlarged and pain was present in the right ilio-inguinal region. The left inguinal glands were also enlarged but not tender. He had a negative Wassermann. For a time he was given X-ray treatment. Later, February 4, 1924, amputation at the junction of the middle and upper thirds of the leg was resorted to. He had shown marked improvement with no recurrence (May 1, 1924) when last seen.

Pathology.—The microscopic section (Fig. 4) shows irregular masses of epithelial cells surrounded by a scanty amount of connective tissue and cellular infiltration mostly of the small round-cell variety. The epithelial cells are arranged in nests. These nests

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are common throughout the section. The cells at the border of the masses are thickly distributed, and the nuclei and protoplasm stain more deeply with haematoxylin than those at the centre. Diagnosis: squamous-cell carcinoma (prickle-cell type).

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CASE VIII.—No. 136, E. G., female, aged twenty, entered the hospital on January 1, 1906. Ten years previous to admission she received a severe burn extending from the upper third of the leg to about the crest of the ilium involving the lower portion of the back. There was also some excoriation on the right thigh. She was confined in bed for two years. In that time the right thigh and the lower portion of the back on the left side down to the gluteal fold entirely healed. The granulating surface remaining was sluggish in cicatrizing and very painful. It never had an offensive discharge till a year previous to admission. At about that time there was discovered a tumor mass distinctly raised from the surrounding skin on the posterior part of the thigh. Examination revealed an extensive grayish tissue typical of carcinoma covering the entire posterior portion of the left thigh. She left the hospital before a positive diagnosis was obtained. In January, 1907, she was readmitted. Examination revealed cicatrization all over the left thigh. Ulcers of the size of a silver dollar (4×4 cm.) were located on the posterior and lateral surfaces of the left thigh. Their base was made up of nodular grayish tissue typical of carcinoma. Extensive curettage was performed and was followed by skin graft. She was discharged on May 5, 1907, with the ulcers completely healed. She has not been heard of since.

Pathology.—The microscopic section stains blue with haematoxylin. Thick epithelial papillæ extend for a long distance into the connective-tissue cells which are cylindrical and stain sharply. Many mitotic figures are seen. Many epithelial pearls are present. The connective tissue surrounding the papillæ are rich in fibroblasts. They also contain scattering mononuclear cells. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE IX.—No. 1603, F. S., female, aged seventy-five, colored, entered the hospital on June 7, 1910. Three years previous to admission a small ulcer was noticed on the outer side of the right thigh (Fig. 5). This had steadily increased in size. When she reported for treatment the ulcer had a diameter of about 10 cm. The tumor was raised from the surrounding normal tissue. The edges were fairly regular but the base was uneven with necrotic tissues and sinuses. The discharge was not profuse but purulent and foul. No operation was performed. She died on January 15, 1914. No pathological section was available but the gross picture is apparently typical of carcinoma.

CASE X.—No. 945, C. L., male, sixty-two years old, entered the hospital, September 9, 1910. About a year previous to admission a lump was noticed on the left groin. This grew slowly and without pain until three months previous to admission when it burst. The mass was cauterized. Examination revealed a mass of the size of a fist (7×7 cm.) at the left inguinal flexure. It was cleft deeply in the centre and had a foul sanguino-purulent discharge. Excision and fulguration of the new growth were employed. The patient was discharged but did not improve.

Pathology.—The specimen shows numerous cell nests separated by adult connective tissue. The nuclei of the cells that make up these nests show a wide variation in their size and shape and staining qualities. The large, oval, fairly deep-staining ones being in the majority. Mitotic figures are numerous. Epithelial pearls are present. There is some congestion and an enormous amount of leucocytes. There are many large atypical cells (Fig. 5). Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE XI.—No. 1314, W. W., male, fifty-three years old, entered the hospital on April 27, 1912. Thirty years previous to admission an ulcer had developed at the anterior portion of the left ankle. It never healed. Discharge was constantly present. Five months previous to admission he was traumatized at the left ankle over this sore. As a result the ulcer deepened and the discharge increased. He was treated at the City Hospital. Examination revealed a cauliflower growth involving nearly the whole foot

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except the toe and heel, and a part of the sole. There was a foul discharge. The inguinal glands were enlarged and suppurating. On July 7, 1912, the leg was amputated at the knee and the inguinal glands were dissected. He left the hospital on August 7, 1912, against the doctor's advice. The patient died soon after, but the exact date and the cause of death were not definitely known. The case had been diagnosed as carcinoma, but the type was not specified and the specimen was not available to me for study.

CASE XII.—No. 13,694, C. W., male, sixty-three years old, entered the hospital on December 12, 1914. Thirty years previous to admission he stepped into some hot grease. The right foot and the lower four inches of the leg were scalded. This healed completely, leaving an extensive scar. About a year previous to admission nodules developed on the scar. Examination revealed several ulcers and nodules typical of carcinoma scattered over the foot. The inguinal glands were enlarged. The right leg was amputated on December 14, 1914. He was discharged on February 19, 1915, with the stump healed.

The microscopic section of the gland showed chronic lymphadenitis without carcinoma metastasis. Section of the tumor was not available, although a diagnosis of carcinoma had been made at the time.

CASE XIII.—No. 21,365. A. M., male, fifty-four years old, entered the hospital, February 23, 1920, for an ulcer on the posterior aspect of the right leg and thigh (Fig. 6). He was burned when he was two years old. Forty-seven years later (five years prior to admission) he noticed that ulceration had started at the site of the old burn. It gradually increased in size. It was not very painful. He had lost ten pounds within the two years previous to admission. The ulcerated area occupied the posterior surface of the lower third of the right thigh, back of the knee, and the upper two-thirds of the leg. The upper medial border showed areas of healing. The edges were raised, undermined, and irregular. The floor was uneven, nodular, and gave a foul discharge. The right inguinal glands were palpable. The ulcer was excised and dressed with dichloramine-T and later was given a skin graft. He had improved when discharged, May 4, 1920. He is now living and well.

Pathology.—The section shows irregular masses of squamous epithelial growths surrounded by connective tissue thickly infiltrated with small round cells. Characteristic epithelial pearls are present. The cells at the border are dense, small, not uniform in shape, have deeply staining nuclei, and show more signs of activity in contrast to the cells in the central area. Diagnosis: squamous-cell carcinoma (prickle-cell type). After



FIG. 8.—Case XVI. Squamous-cell carcinoma of the foot.

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the tumor was removed, excessive growth of granulation tissue occurred. The tissue removed showed no recurrence of cancer growth.

CASE XIV.—No. 24,286, C. K., female, eighty-seven years old, entered the hospital, November 15, 1921, for a tumor under the right heel and in the groin. No satisfactory history of the duration of the disease could be obtained. The tumor mass in the heel was excised on December 13, 1921. She was very much improved. She reported for further observation on January 11, 1922. The wound was almost healed. Her daughter believed that the lump in the groin was increasing in size. She died in July, 1923, but the cause of death was uncertain.

Pathology.—The specimen is that of a tumor mass measuring 4 x 5 cm., flat and slightly pedunculated. The greater part of the surface is made up of two ulcers surrounded and separated by gray, opaque skin. On section the tumor is gray, slightly translucent material which is broken up into irregular sized parts by dense fibrous partitions. Some parts show central degeneration. The microscopic section stains blue with haematoxylin. The mass is made up of two kinds of epithelial cells, the round or cuboidal and the spindle. Both of these have deeply staining nuclei. The round or cuboidal cells are mostly arranged in strands separated by very scanty amount of connective tissue. The spindle cells are mostly arranged in globular masses of different sizes surrounded by a scanty amount of connective tissue. No epithelial pearls are present.

Diagnosis: basal-cell carcinoma (?).

CASE XV.—No. 24,796, P. L. P., male, fifty-one years old, entered the hospital, February 6, 1922. Twenty years previous to admission he had a

FIG. 9.—Case XVII. Front view of the legs showing varicose ulcers on the right and squamous-cell carcinoma on the left.

small, red, scaly papule on the extensor surface of the forearm near the elbow. It gradually spread all over the upper extremities. Later, it developed on the thigh and spread all over the lower extremities except the sole of the foot. Scales were present. He complained of itching and burning sensation. There was no pain. At times the skin cracked in places. For the last four years prior to admission there had been a growth on the anterior surface of the left leg just below the knee (Fig. 7). It measured 2 cm. in diameter. It was tender and was covered by a dark crust which was adherent. On the middle third of the thigh, on its lateral aspect, was a new growth 2 cm. in diameter. It was raised, ulcerated, and bled readily. It was indurated and tender. The floor had a grayish, slightly granulated opaque appearance. The discharge was offensive. The case was diagnosed clinically as psoriasis with secondary carcinoma. The treatment consisted in cauterization and radium application followed by skin graft. He was very



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much improved when discharged, July 2, 1922. The final result of the treatment was uncertain for the patient has not been heard of since.

Pathology.—The microscopic section stains blue with haematoxylin. It consists of irregular masses of epithelial cells with dark staining nuclei. The cells at the margin are smaller, more dense, and possess more darkly staining nuclei than those at the centre. Few epithelial pearls are present. Mitotic changes are found mostly among the marginal cells. There is a moderate amount of cellular infiltration. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE XVI.—No. 254,251, M. W., female, seventy-seven years old, entered the hospital on June 24, 1922. Seven years previous to admission she stepped on a needle. Eight months previous to admission she noticed a sore on the ball of the big toe of the right foot. She had picked the point of the needle out of this sore. Examination revealed a soft plantar verruca about the size of a butter bean (1.5×2.5 cm.), (Fig. 8). It bled readily. The lesion was excised on July 5, 1922, and soon after radium was applied. She was discharged on July 21, 1922, when the wound was showing a healthy granulation tissue. After a year she returned with an ulcer on the old scar. Silver nitrate was applied and the ulcer seemed to have improved.

Pathology.—A microscopic section of the excised lesion shows dense masses of squamous epithelial cells extending down into the underlying connective tissue. These masses are thick and placed closely together. Dense masses of small round cells fill the tissue about the deeper ends of the invading papillæ. No epithelial pearls are seen. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE XVII.—No. 26,340, C. L., female, sixty-seven years old, poorly nourished, and poorly developed. She entered the hospital on January 1, 1923, for ulcers on both legs. The ulcer on the right leg was situated anteriorly above the ankle. It had an irregular outline and was diagnosed varicose ulcer. Since about a year previous to admission the ulcer of the left leg had grown more rapidly than ever before. It was an extensive ulceration. On admission it measured 30×15 cm. and was situated on the anterior surface. It extended from near the ankle to almost the level of the knee. It had a cauliflower appearance (Fig. 9). The discharge from it was foul. The base was irregular and papillomatous. In some places the base was hard, in other places it was soft. The skin below the knee and down to the ankle had a thin, gray, opaque appearance. The inguinal glands on both sides were enlarged, firm, and discrete. Amputation was performed through the junction of the middle and lower thirds of the left thigh. She was discharged on March 23, 1923. Attempts to locate the woman in order to ascertain subsequent results have proved fruitless.

Pathology.—The microscopic section shows dense masses of epithelial cells. At the outer edge the cells are pink and the nuclei stain poorly. Along the inner edge the cells stain deeply with haematoxylin. Mitotic changes are present. Numerous epithelial pearls are seen scattered over the epithelial growths. There is a moderate lymphocytic reaction between the epithelial mass and the underlying connective tissue. The skin shows a marked hyperæmia in the neighborhood of the tumor. Diagnosis: squamous-cell carcinoma (prickle-cell type).

SUPPLEMENT

This case is not included in this series, for it came under observation just lately. The importance of the case justifies its being reported. The following are the salient facts about the patient:

J. L., male, fifty-two years old, was admitted to the Out-patient Department of Barnes Hospital, April 12, 1924, for a tumor on the right leg. Fifteen years previous to admission he had an injury on the right leg. Repeated injuries subsequently on the site of the old trauma resulted in the appearance of the tumor one year previous to the

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date of admission. Examination revealed a cauliflower growth on the right leg. It measured 10 x 8 cm. It had a purulent foul discharge. Varicose veins were present on both legs. The inguinal glands were enlarged on both sides. The liver was enlarged and presented multiple nodules which in all probability were metastatic. There was no pain. Jaundice was not evident. Up to the writing of this supplement (May 14, 1924), the patient has been under X-ray treatment for the primary growth and the tumor is gradually subsiding.

Microscopic Diagnosis.—Squamous-cell carcinoma (prickle-cell type).

SUMMARY AND CONCLUSIONS

1. Cutaneous carcinomata of the lower extremities seem to be never a primary condition. They arise on an old ulcer or some other lesion.
2. They are very rare. They comprise not more than 1 per cent. of all the carcinomata in the different parts of the body, and 1 to 4 per cent. of all the cutaneous carcinomata.
3. They are more common in men than in women, at least 2:1.
4. They are more common above the age of fifty, but can be found even at an early age of twenty.
5. Trauma and burns play a very important part as exciting etiological factors.
6. The rôle of syphilis as a predisposing etiological factor in cutaneous carcinomata of the lower extremities is not as yet fully established.
7. Varicose veins and varicose ulcers are not the most important predisposing factor in the etiology of most of the cutaneous carcinomata of the lower extremities.
8. Cutaneous carcinomata of the lower extremities produce metastasis in the inguinal glands, either on the corresponding side alone or apparently on both sides, but mostly the former. Metastasis takes place early in some and late in others.
9. In cutaneous carcinomata of the lower extremities arising from trauma, the interval elapsing between the infliction of the injury and the appearance of the tumor varies from three months to fifty-four years.
10. Most of the cutaneous carcinomata of the lower extremities are of the squamous-cell variety (prickle-cell type).

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SOME BIOLOGIC EVIDENCE OBTAINED FROM A STUDY OF CONGENITAL DISLOCATION OF HIPS IN IDENTICAL TWINS SUPPORTING THE DEVELOPMENTAL THEORY

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THE development of the etiology of congenital hip dislocation has hardly kept pace with that of treatment. While the theories have developed along two main lines, that is, developmental and mechanical, after all there remains

but a narrow chasm between them.

If the acetabulum does not develop sufficiently to hold the head, dislocation results and we have the normal mechanical balance upset with lack of development of the head. On the other hand, one can see that an over-development of muscular power about the hip could bring about a dislocation. There is no better demonstration of fact that the wonderful symmetry and power of our bodies is absolutely dependent upon growth coupled with definite strains, stresses and mechanical functions, than is shown in congenital dislocation of the hip.



FIG. 1.—Early stages of twin chicks developing from single ovum.

That eighty-eight per cent. of congenital dislocation of hips are found in girls is an extraordinary fact. I can not believe that trauma, either internal or external, can account for it. Or that women being of the more primitive type are naturally more subject to congenital accidents. One might be led to conclude that there is some fundamental difference between the hips and pelvis of male and female *in utero*. Girls have practiced hyperflexion of the hip in dancing for countless generations. This is a mere suggestion. I believe in Lamarck's theory of the transmission of acquired characters. Congenital hips show a marked hereditary factor.

I had the opportunity in 1922 of reducing congenital hips in identical twins. Before reporting them I wish to say a few words about the biology of identical twins as a basis for our observations.

By identical twins we mean duplicate twins of the same sex and identical

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features. It is proven that they develop from a single ovum. Reference to Fig. 1 shows two chick embryos developing from a single egg. I discovered this specimen in 1915. There is a sharp line of demarcation at right angles to the main axis of the embryos passing between the head folds which are together, thence through the pellucid and opaque areas. The embryos seem to face one another.

In the transparent eggs of the common water snail, *Lymnophysa heterostropha*, I have often observed twins developing, also odd numbers up to seventeen in a single egg. Figure 2 shows the early stage (gastrula) of a Siamese snail. Figure 3, the same at hatching time. In the armadillo twinning is a normal process and has been studied extensively by Neuman.

Another fact in regard to identical twins is that peculiar integumentary phenomena of mirroring. That is the finger or toe print may have an exact

mirror image of the corresponding member. In the cases that I will report we find in addition to integumentary mirroring, mirroring of some mesodermal structures; also a habit mirroring as sucking of opposite thumbs at night.

The following case is herewith reported:

Miriam B., and Madeline B., females, white, aged four, identical twins, were brought to my hospital, April 26, 1922.

The patients' mother gave the history that the twins were born at normal delivery, no forceps being used and that the mother suffered no injuries during gestation.

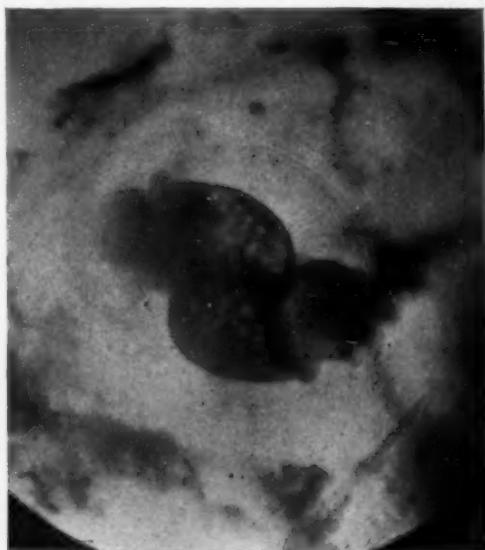


FIG. 3.—Siamese twin snails about hatching time.

The twins did not try to take a step until they were twenty-three months old, although they were encouraged to do so. To this time nothing abnormal had been noticed about the

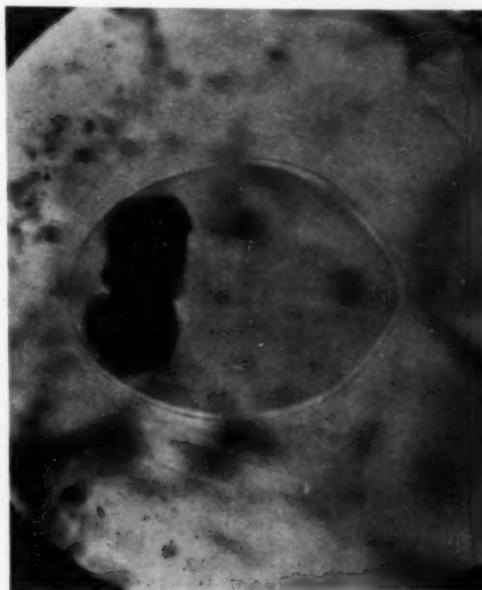


FIG. 2.—Early stage of Siamese twin snail.

twins. Both were very reluctant to perform the function of walking and soon the mother noticed that one child dragged her right leg and the other the left leg.

Both twins complained more or less with pain in their backs and their lameness gradually became more emphasized. In April, 1922, the children were brought to an Orthopaedic Clinic which was held at Wilmington, Ohio. Doctor Steinfeldt, of Columbus, the examining physician, diagnosed congenital dislocation of the right hip in one twin and of the left in the other, and advised them to submit to immediate treatment for the correction of the condition. The same day X-ray examination at my hospital confirmed the diagnosis of Doctor Steinfeldt.

Previous History, etc.—The habits of both have been regular; sleep well; appetites only fairly good; and bowels regular. Both have had tonsillitis and the one with the left congenital dislocation of the hip has had pneumonia. Neither have had any other illness or injuries.

Family History.—Does not reveal anything relevant to the case. Both parents are living and in good health; also two sisters are living and in good health. No deformities. Maternal and paternal grandfathers died of tuberculosis. No cancer in the family. No cases of congenital dislocation of hips in the family.

FIG. 4.—Congenital dislocation of left hip, associated with right internal strabismus.

parents are living and in good health; also two sisters are living and in good health. No deformities. Maternal and paternal grandfathers died of tuberculosis. No cancer in the family. No cases of congenital dislocation of hips in the family.

Physical Examination.—The twins so closely resemble one another that it is impossible for the nurses to distinguish them. Only the mother can be positively sure of the identity of each. They are both about thirty-six inches tall and weigh $24\frac{1}{2}$ and 24 pounds, respectively. They have light brown hair, blue eyes, and clear complexions. Madeline, Fig. 4, with the left dislocation has a small haemangioma on top of her left shoulder and internal strabismus of the right eye and sucks her right thumb; the other, Miriam, Fig. 5, having internal strabismus of the left eye and sucks her left thumb. Both are right handed. They have no other deformities. Heart, liver and lungs normal. Stomach, abdomen, intestines normal. All other systems normal.

Fluoroscopic examinations made of the patients do not reveal transposition of any of the viscera of the thorax and abdomen.

Careful examination of the finger prints showed a striking similarity in the respective



FIG. 5.—Congenital dislocation of right hip, associated with left internal strabismus.

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hands, but there was no mirroring of the index fingers as often occurs in monozygotic twins. Study of the toe prints revealed a symmetry reversal or mirroring of the prints of the left great toes. Neuman states that identity in friction ridge patterns of twins makes their monozygotic origin very highly probable.

These patients entered my hospital, May 8, 1922, and submitted to the following treatment.

The patients were given a general anaesthetic of ether in order to reduce the dislocations. The heads of the femurs could be placed readily in the socket and by abduction the adductor muscles were thoroughly kneaded and stretched. Both limbs were placed in plaster cases after being flexed and abducted. The cases were placed around the waist and hips down to the tips of the toes over a union suit. The sacrum, hips and knees were thoroughly padded before applying the cases.

X-ray examination in a few days showed that Miriam's right femur had slipped out of the acetabulum either during application or after application of the case. This was probably fortunate in a way as it brought about stretching of the adductor muscles so that when a second case was placed, the muscles could be entirely abducted and with both limbs in position, the case was put on. X-ray examination the same afternoon revealed that the head of the femur was in the acetabulum.

After spending thirteen days in the hospital, the patients were sent home for two and a half months, during which time they were to spend most of their time out of doors in the sunshine. They were directed to return to the hospital at the expiration of this period.

July 24, 1922, the patients returned. After first making X-ray examinations of them in the cases to determine that the heads of the femurs were still in the acetabulums, the cases were removed by Doctors Tribbet and Ruble and the patients given a thorough cleansing. Under general anaesthesia of ether the affected limbs, respectively, were extended and rotated inward. Cases were applied in this position encircling the pelvis and abdomen up to the umbilicus. The unaffected limbs remained free.

Subsequent X-ray examinations revealed the fact that the heads of the femurs were still in the acetabulums.

After spending four days in the hospital in order that the patients might become accustomed to their cases with their limbs in the new position, they were sent home for ten weeks to spend the major portion of the time out of doors and to have nourishing food, etc.

The patients returned October 9, 1922, and the cases were removed. X-ray examinations revealed excellent results in both cases.

I think that from a study of these two patients we can arrive at the following brief conclusions: 1. That they were monozygotic twins. 2. The congenital dislocations in these patients were developmental in origin, not traumatic for the following reasons (because I think these facts are associated): (a) Mirroring of left great toes. (b) Mirroring of internal strabismus of right and left eyes. (c) Habit mirroring, that is, sucking opposite thumbs during sleep. (d) Mirroring of dislocations. 3. Multiple pregnancy as a causative factor has to be considered; but it would indeed be a strange coincidence to have these dislocations occur as they did from a mere mechanical force. 4. Mirroring of structures other than integument has not been noted before as far as I can learn.

ACUTE OSTEOMYELITIS IN CHILDREN*

BY CHARLES E. FARR, M.D.

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ACUTE osteomyelitis is generally considered to be a blood-born infection in the marrow of the long bones. Most surgeons believe the condition is one of septicaemia followed by pyæmic manifestations in the bone and is comparable to abscess in the lungs, liver, or kidney. The usual causative agents are the pus-producing organisms, staphylococcus, and streptococcus, but occasionally others are found.

Much has been written as to the portal of entry for these organisms, but nothing definite has been established. The staphylococcus is the most common invader, and this is found of course universally in the skin, but not so commonly in the mouth and intestinal tract. Many cases of acute osteomyelitis can be traced fairly definitely to furuncles, and some to preceding tonsillitis and gastro-enteritis. The question of a specificity of these pus organisms for bone lesions or the sensitization of these bones for the specific organism, is one of the most interesting problems still awaiting solution.

Theoretically every case of acute osteomyelitis should give a positive blood culture at some stage in the disease. Practically it is quite difficult to recover the organism, just as it is in pneumonia, typhoid fever, and other bacteraemias.

The relationship of trauma to osteomyelitis is very interesting and a much controverted point. There is a general impression that a local trauma in some mysterious way causes bacteria to pass into the bone and produce an osteomyelitis. It requires but little thought to show that this can hardly be true. Even if the skin and soft tissues are extensively lacerated, and the bone exposed, true osteomyelitis rarely develops. In fact, any compound fracture may result in a form of osteomyelitis, but rarely with the clinical picture of the disease as seen in the spontaneous type.

The belief in trauma as an etiological factor will not bear close scrutiny. The history is nearly always of a slight blow or fall with almost immediate symptoms of disability accompanied by fever, swelling, and great pain. On analysis this will usually prove that the osteomyelitis began at this time with such sudden onset as to cause the child to cry out with pain, and even to fall.

Although our records will give a history of trauma in about one-third of the cases, in no instance has there been local evidence of trauma of the skin or of the soft parts. Moreover the infection always starts within the bone and very often in that part of the bone most protected from trauma, and farthest removed from the alleged trauma. The rarity of infection of simple closed fractures, the ideal setting for osteomyelitis according to the trauma theory, is another strong negative argument.

* Read before the Springfield Academy of Medicine, September 9, 1924.

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Slight blows and sprains of the extremities without visible findings of injury and with negative X-ray findings have been advocated by some as the underlying cause of osteomyelitis. In rebuttal it can only be stated that this is purely theoretical, that no proof can be adduced which will pass critical examination and that the multiplicity of such injuries in every normal active child would negative their importance as etiological factors.

Certainly in the great majority of cases there is no history of injury and no probability of it. As we do not include trauma as one of the usual causes of abscess of the lungs, liver, and kidney, it hardly seems rational to insist upon it as the cause of a similar condition in bone.

The obvious reason for the selection of the long bones in growing children is the slow blood current in the tortuous channels at the ends of the bones. These channels are narrow, tortuous, and inelastic, the ideal locus for any small embolus to lodge in. It is also possible that large emboli at times block the larger vessels of the long bones.

This again is purely surmise, as naturally enough no proof can be adduced.

Animal experiments have shown it difficult to produce osteomyelitis without trauma, but the conditions are quite different. If one could use very young animals, and those especially susceptible to staphylococcus, and employ the sensitized germ which has already produced osteomyelitis in the human, the result of animal experiments would be more trustworthy.

The pathology of acute osteomyelitis is exactly that of any other acute infection with the additional factor of the bone involvement. The stages of inflammation, congestion, exudation, infiltration, death of tissue, suppuration, sloughing, sequestration, and healing are all present. The symptoms are more severe at the onset because of the dense bone envelope. The process in its chronic stage is more prolonged because of the slow healing power and difficulty in casting off sloughs.

The symptomatology is that of any severe infection, with fever, chills, rapid pulse, delirium, and prostration in the more severe cases. Locally, there is pain which is usually severe, considerable heat, redness, swelling, and loss of function.



FIG. 1.—Acute osteomyelitis of tibia, low power.

The differential diagnosis is by no means easy. Acute articular rheumatism is a most common diagnosis where osteomyelitis is the real cause. A careful study of the history and of the physical findings will always rule out rheumatism in the more severe types of infection. In the milder cases it is sometimes necessary to await events. The leucocyte and the differential counts in osteomyelitis are usually high, but this will not serve to differentiate the condition from any other infection. Our counts have ranged from 10,000 to 60,000, the average being around 20,000, with an average polymorphonuclear of 80 per cent.

Oddly enough while physicians occasionally mistake these cases for rheumatism, the surgeon not uncommonly mistakes them for injury. This is due to hurried, careless examination. The story of injury and the swollen extremity are the only two factors pointing to fracture. The exquisite tenderness, the redness with local heat, the increase in tempera-

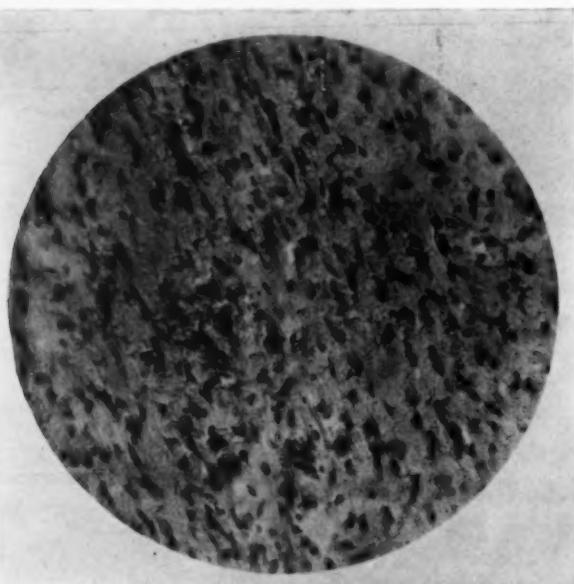


FIG. 2.—Osteomyelitis of tibia, high power.

ture, the high blood count and differential, the rapid pulse with prostration, should be sufficient to establish the correct diagnosis at once. Syphilis, tuberculosis, rickets and scurvy, are to be thought of in the milder cases. The differential diagnosis is not always easy, and again this depends upon careful study. X-rays in acute osteomyelitis are of practically no value until the tenth day. In the meantime if one waits for this evidence irreparable damage will be done. The X-ray should be taken as a guide in the progress of the disease, but no reliance can be placed on a negative film.

For the purpose of classification and of treatment, osteomyelitis is divided into several types. We distinguish between fulminating, severe acute, acute, and the mild types. This of course is based entirely on the surgeon's judgment of the severity of the case, but is useful to determine treatment, and for prognosis. The fulminating cases probably can never be saved. The patient is overwhelmed from the very onset with extreme toxæmia, and usually dies about the time of the appearance of the first local signs in the bones. No form of treatment seems of any avail. We all strive, however, to locate the first bone lesion, and drain it.

ACUTE OSTEOMYELITIS IN CHILDREN

The severe acute cases are those with high temperature, great prostration, and slight, but definite local signs. In these a simple drainage operation is performed, cutting through the soft parts, separating the periosteum and occasionally entering the bone proper. More often the bone is left alone, the wound is packed open for from twelve to twenty-four hours, and later the marrow is exposed. At the original operation a considerable amount of serum and sero-pus is found around the bone. This has seeped through along the metaphyseal line, and the perforation can often be felt. The temptation to more radical surgery is great, but results are very often disastrous. The condition is not unlike severe spreading peritonitis, where the simplest possible drainage operation is most successful.

The ordinary acute case of osteomyelitis with temperature of 102° F., moderately rapid pulse, slight prostration, and marked local reaction, can safely be treated more radically. The bone is freely exposed, the cortex is chiseled away, and the marrow uncovered. It is not wise to prolong the operation, nor to curette or disturb the marrow in any way. Here results of surgery depend largely on the judgment of the operator in not going too far. Little children with such severe infections are easily shocked, and the immediate post-operative mortality is high where radical surgery is attempted.

It should always be borne in mind that children have great healing power and that simple drainage is often sufficient without radical measures. Treatment by total ostectomy has been advocated and tried, but it is needlessly severe, and not particularly successful in its immediate or remote results.

Finally there are mild types of acute osteomyelitis with little or no systemic reaction, and but moderate local signs. These can be treated by fairly radical excision of the focus with excellent results in experienced hands.

The after-treatment of cases of osteomyelitis requires great patience and



FIG. 3.—Old osteomyelitis of the left femur, showing one and one-half-inch lengthening.

attention to detail. Simple cleansing with very mild antiseptics, preferably Dakin's solution, is the most effective method. Dressings should be frequent and the skin should be kept clean. Splints must be used if the bone is greatly weakened. No special general or local medicaments have proved of any use. Blood transfusion is of great value in the anaemia which so constantly follows general sepsis. Various forms of light therapy are also useful for general



FIG. 4.—Old osteomyelitis of head of the femur with dislocation.

tonic and healing effect. Needless to say fresh air, sunlight, and good food are as efficient here as in any other state of lowered vitality.

The complications of acute osteomyelitis are really extensions of the original process into the neighboring parts, especially in the soft parts, and the joints, or by means of the blood stream into the internal organs, particularly the liver and lungs. One should always be on guard against extension along the shaft in the marrow, especially into the adjacent joint. This can be recognized by increased temperature, swelling, local heat, and pain. Free drainage and active motion will result in excellent function, even in this desperate condition.

The period of disability in osteomyelitis is very long. Healing may occur in three months, or three years, or never. It depends on the location of the principal lesion, and upon the thoroughness with which it can be treated. Relapses are common even after many years,

The end results as regards function are of interest. If the epiphysis has been severely damaged there will be shortening and deformity. Occasionally

ACUTE OSTEOMYELITIS IN CHILDREN

the epiphysis seems to be stimulated by the infection and overgrowth takes place. One of our cases of this type has an inch lengthening of the femur.

In the case of paired bones, the altered growth of one becomes a serious matter in the function of the adjacent joints. This is true also where one condyle is involved more than the other. The resulting valgus, or varus, is very difficult to control.

Splints and braces are tried, and corrective operations must be resorted to in the more pronounced cases.

In younger children the power to digest soft bone and to replace dead bone by living is very great. Many of our cases show large sequestra early in the disease, but later these are surrounded by involucrum and very frequently are absorbed and replaced by new bone. These new-formed shafts of the long bones are never quite normal, but they serve their purpose well.

At St. Mary's Free Hospital for Children during the years 1914 to 1924 there have been 98 cases of acute osteomyelitis, divided as follows:

Femur	20	Radius	5
Tibia	14	Multiple	10
Mandible	11	Fibula	3
Humerus	9	Rib	5
Tarsus	5	Ulna	2
Cranium	4	Scapula	1
Os calcis	4	Clavicle	1
Metacarpals	4		

Of these 58 were boys and 40 were girls. There were six deaths, or slightly over 6 per cent. Two were discharged as unimproved, 90 were considered improved or cured, this depending entirely on the optimism of the House Surgeon.



FIG. 5.—Osteomyelitis of the *os calcis* with marked destruction of bone.

CHARLES E. FARR

Many records were incomplete because of war conditions. The following data are as accurate as careful study can make them.

Number of cases giving definite history of injury, 20.

Number of cases giving doubtful history of injury, 35.

Those giving no history of injury, 43.

In no single case was any physical evidence of injury found.

Only 43 cultures are recorded in the charts. Of these there are: 26 for *staphylococcus aureus*; 5 *staphylococcus* and *streptococcus*; 4 *staphylococcus albus*; 1 *streptococcus*; 2 *pneumococcus*; 1 *streptococcus* and *staphylococcus* and *diphtheroid*; 4 were reported as sterile or no growth; 4 only gave positive blood cultures according to the records. Of these two died and two recovered.

CONCLUSIONS

1. Acute osteomyelitis in children is a manifestation of septicæmia with pyæmic abscesses in the bones.
2. The portal of entry for these organisms is frequently the skin.
3. The probable underlying cause is a state of lowered vitality and resistance to infection.
4. Local trauma plays a minor if any rôle in the causation.
5. Early recognition and drainage will save a large proportion of the cases.
6. As in all other infections the general resistance of the patient and the virulence of the invading organism are the two essential factors.

RECONSTRUCTION OF HIP-JOINT DISORGANIZED BY CHARCOT'S DISEASE

BY JOSEPH P. HOGUET, M.D.
OF NEW YORK, N. Y.

CHARCOT's disease or tabetic arthropathy is not a rare condition and most frequently occurs in the joints of the lower limbs. The knee is most commonly involved and the hip-joint next in frequency. Platow, quoted by Whitman, reports sixty cases in the knee, thirty-eight in the hip, thirty in the foot and twenty-seven in the shoulder.

This condition may occur as a simple chronic synovitis or more usually as a destructive osteoarthritis with erosion of the joint cartilage and bone, hypertrophy of the synovia and irregular formation of bone and cartilage around the periphery of the joint. Pathological fractures of the bones of the joint frequently occur on account of the destruction of bony substance and in these cases non-union is practically always seen. Anti-syphilitic treatment has often been found to be of little benefit in these conditions.



FIG. 1.—Condition of hip-joint, found immediately after sudden development of disability, December 17, 1923.

The following case has been thought to be of sufficient interest to be reported for the reason that, as far as the writer knows, this is the first case of Charcot's disease of the hip to be treated by the reconstruction operation of Royal Whitman. Up to the present time, these cases have been given no relief, except by a hip brace, and have only been able to get about with the greatest difficulty. The reconstruction operation is the only one suitable for a Charcot hip and judging from this case is the only kind of a procedure which can make a strong, movable, serviceable joint.

Another important point is that, in this case, there was practically complete destruction of the neck of the femur up to its junction with the shaft. The head was distorted in shape, as can be seen in the photograph, and all the articular cartilage on its upper surface had disappeared. Radiographs taken during the last two years show that the disease has not progressed and that it has not extended into the shaft. The great trochanter which had been cut away and fastened into the shaft lower down is still solidly in place. The irregular new bone formation has not progressed and apparently the disease is at a standstill. Few of these arthropathies have ever been operated upon,

so that it is very difficult to foretell what will happen in these cases. In this patient the reconstruction operation was done as a last resort and it was not known what the outcome would be. As it did result so favorably, it may be possible to resect some of the early cases of Charcot knees and, possibly, with a large inlay graft, to secure bony union between the femur and tibia.

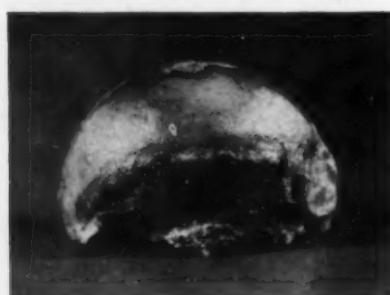


FIG. 2.—Head of femur found loose in acetabulum, showing flattening and loss of articular cartilage.

N. S. is a Russian and at the time of the operation was twenty-nine years of age. Except for an attack of typhoid fever and bronchopneumonia in his youth, he was perfectly well until 1913, when he contracted syphilis. For this he was actively treated in Moscow for seven months and for another four months in Texas. He had no further anti-syphilitic treatment until 1916 when, although he had a negative blood Wassermann, treatment was resumed and continuously carried on until December, 1921. Early in 1922, he found that he was becoming more and more nervous, he had occasional attacks of hysteria and of hallucinations and failure of memory. He had no headaches, but seemed to have poor control of his legs to a certain extent, so that he was afraid to climb stairs or walk on uneven surfaces. Treatment was then resumed with mercury and iodides.

On April 8, 1922, in Berlin, he was struck by an automobile. He was brought to a sanatorium where he was found to have a cerebral concussion, but no fractured skull. At this time a spinal tap was done and he was found to have a positive Wassermann in the spinal fluid. For the following eight weeks he was treated by injections of serum from patients with malaria with a marked improvement in his mental condition. His nervousness and irritability improved continuously, so that he resumed his work in August, 1922.

He came to the United States in October, 1923, and in December of that year noticed a swelling of the right hip-joint, for which he was referred to the writer on the tenth of that month. On examination, at that time, a moderate swelling of the right hip-joint was found, but motion was free and only slightly painful. He remained off his feet for a few days and the condition rapidly improved, so that he resumed his work as a salesman. On December 17, 1923, while walking, he suddenly felt his hip give way and fell to the ground. He was removed to his home in a taxicab and from there was brought to the Ruptured and Crippled Hospital. On his entrance there, he was found to have the typical deformity of a fractured neck of the femur, which was demonstrated in the radiograph (Fig. 1).

He was operated on December 28, 1923. On cutting down on the neck of the femur, a fracture with a great deal of destruction of the neck was found and the whole joint was filled with a sandy material that could be scooped out with the fingers. The deformed

RECONSTRUCTION OF HIP-JOINT IN CHARCOT'S DISEASE

head of the femur was found loose in the acetabulum, the ligamentum teres having disappeared. The head was found to be oval, with a great deal of flattening on the upper surface, which was rough and uncovered with cartilage (Fig. 2).

The great trochanter with the gluteal muscles attached was cut off obliquely from the shaft and the upper end of the femur smoothed off so that it would fit into the acetabulum. The great trochanter was then brought down and fastened to the outer surface of the shaft of the femur about three inches below with two beef bone screws while the limb was held in wide abduction. The wound was closed without drainage and the leg held in wide abduction by a plaster-of-Paris spica.

The patient made a very good post-operative recovery and the plaster was removed at the end of the fourth week. It was then found that he had an extremely good range of passive motion, but with the hand over the joint a peculiar grating was felt. There was less than one inch of shortening in the leg. He remained in bed without plaster for another two weeks and was then allowed up on two crutches. A radiograph taken at that time showed the new head of the bone in good position in the acetabulum and a great deal of new bone formation in the new joint, which accounted for the grating sensation. He then left the hospital, and for a full year was actively treated with anti-syphilitics during all of which time the blood Wassermann was negative.

His general condition improved slowly and the range of motion in the hip became greater. He discarded one crutch at the end of six months and the other at the end of a year, but still continues to use a cane, as he has not regained perfect confidence in the new joint.

He was last examined on December 17, 1925, when his general condition was found to be excellent, although his weight had not increased very much. He now uses a cane only when out of doors. There was slightly more than one inch of shortening in the right leg. Active and passive motion in the hip were practically normal, although there was a slight muscular atrophy in the muscles above and below the knee. The grating sensation in the joint had almost disappeared. His nervousness and irritability had gone and he said that he was capable of very good mental work. A radiograph, taken at that time (Fig. 3), showed the same formation of new bone, but that the disease had not progressed further down the shaft of the bone.



FIG. 3.—Radiograph taken December 17, 1925.

UNUNITED FRACTURE OF THE HIP*

BY MELVIN S. HENDERSON, M.D.

OF ROCHESTER, MINN.

FROM THE SECTION ON ORTHOPEDIC SURGERY, MAYO CLINIC

THE teaching that non-union is expected to follow a fracture of the neck of the femur is now definitely relegated to the past. Undoubtedly such fractures are better treated than they were formerly, owing largely

to the writings and the teachings of Whitman, who has persistently advocated the abduction method. Nevertheless, we still see too many people with non-union of the neck of the femur dragging themselves about, lame, disabled, and suffering great pain and discomfort. Impetus was given to renewed interest in non-union of the hip by the bone-grafting operation, introduced fifteen years ago. A review of the cases of old fracture of the hip which have been seen in the Mayo



FIG. 1.—Successful bone graft for non-union of more than three years' duration. Note partial restoration of the neck of the femur.

Clinic during the last six years, 1919 to 1925, inclusive, will be presented in this paper, with the object of evaluating the different procedures employed to relieve the patients.

Selection of Cases.—Non-union of the hip does not in itself demand surgical interference. There is no reason to subject elderly persons to the risk and confinement accompanying operation when they have comparatively little discomfort and can get about with a cane or crutch well enough to accomplish satisfactorily the social and business activities incident to the declining years of life. Also, certain younger persons who would be excellent surgical risks have fibrous union of such strength that function is remarkably good. I recently encountered an example of this in a coal miner, aged forty-five, who had a limp and occasional soreness in the leg but no pain, and was able to carry on his work efficiently in spite of the fact that röntgenograms

* Read before the Minnesota Academy of Medicine, Minneapolis, March 10, 1926.

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taken five years after the accident showed typical pseudoarthrosis. Obviously there was no reason to subject him to an operation. Therefore, the patients who require operation are those who are not too old and are seriously disabled, or older ones who are equally disabled but have an expectancy that will warrant the risk and expenditure of time incident to operations of this kind. Certain older patients whose pain and discomfort are so great that they are anxious for relief are nevertheless entitled to their opportunity and may

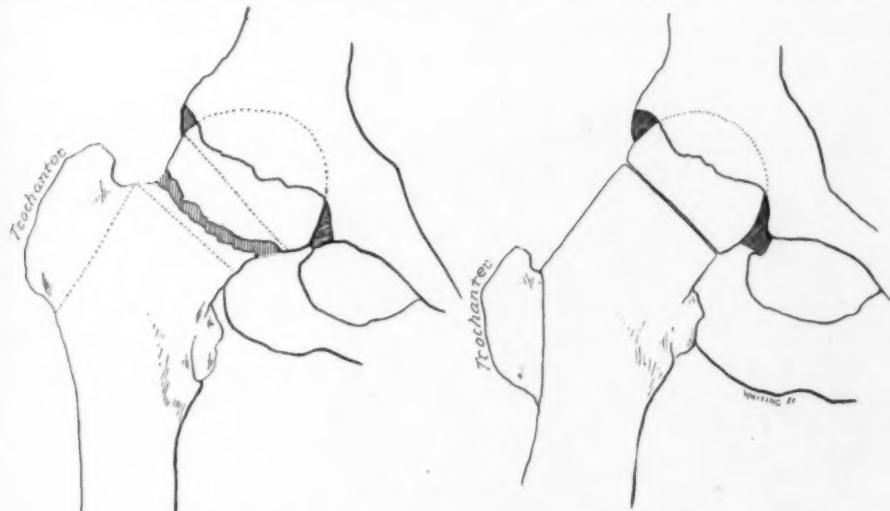


FIG. 2.—Reconstructed neck placed against the head of the femur.

be operated on after careful and frank consideration even though they are not Grade 1 risks.

Types of Operation.—The various types of operation have been described as reconstruction operations, the actual reconstruction being in proportion to the loss of substance of the neck and the viability of the head. I believe that the head is rarely dead, although this is often given as the reason for demanding its removal and as an argument against the bone-grafting operation. The blood supply to the head is poor and the cartilage obtains most of its nourishment from the synovial fluid. The vessels accompanying the ligamentum teres carry the blood to the bone in children, but there is some question as to how much these vessels nourish the head of the femur in adults.

The operation of choice is undoubtedly that wherein one exposes the fracture, freshens the fragments, carefully reshapes the ends, so that they fit accurately, and, after drilling a hole through the trochanter, remnant of neck and well into the head, drives an autogenous bone graft firmly into the channel as a peg for fixation and a physiologic stimulation to the formation of bone (Fig. 1). Care must be taken to see that the head is really freshened, and that the freshened end of the neck is held firmly and accurately with broad contact against the denuded head. In all the cases reported in this series wherein the bone graft was used the fibula was employed. The graft is taken

from the lower half of the fibula, about 7 or 8 cm. above the tip of the malleolus, and consists of about 8 or 9 cm. of the bone in its entire thickness. Before driving it into the channel prepared for it, one end is slightly pointed and all the muscle and as much of the periosteum as possible are stripped off. No inconvenience is caused the patient by the loss of bone, although the gap in the fibula never fills in. If the patient were to fracture the tibia later, it might be a complication in setting the leg. The patient is always told of its removal and that in that area there is but one bone left. Such a graft is a

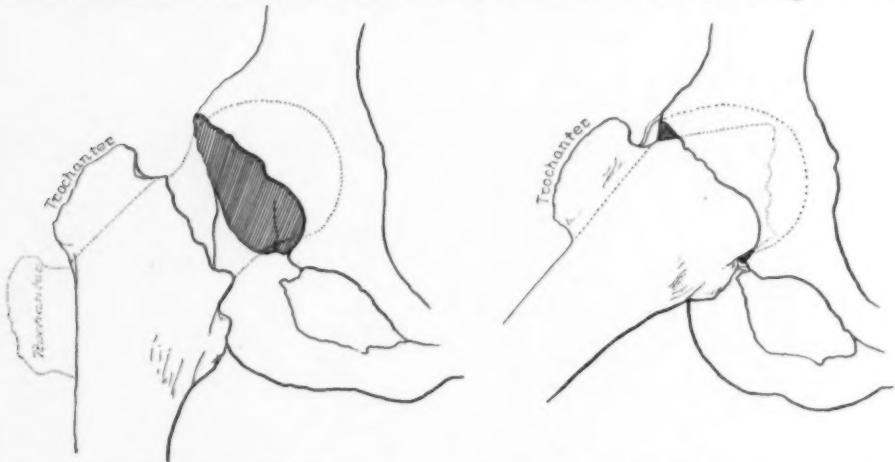


FIG. 3.—Head removed and reconstructed neck placed in acetabulum. Trochanter moved down.

large strong peg; with its use our results have been better and it is at least one improvement in our technic that I believe is partially responsible for our increased percentage of cures. I am confident that most of our poor results have been due to the fact that broad, firm contact between the neck and head has not been obtained and thus a gap was left with only the bone graft to bridge it. Under these conditions the graft slowly weakens in the part bridging the gap and the regenerative properties of the head and neck of the femur, bathed as they are in synovial fluid, are insufficient to bring about union. The final picture is a fracture of the graft, in other words, non-union. This particular type of operation is a difficult one and not to be undertaken lightly. Even under the best conditions of exposure, careful apposition of the fracture surfaces is not easy and taxes the ingenuity of the surgeon.

Generally speaking, the autogenous bone-peg should only be used when a fair amount of the neck of the femur is left. Often it is concluded that there is no neck left because little shows in the röntgenogram. If it is taken with the leg rotated outward, the neck is looking directly anterior and casts no shadow; therefore, care must be taken to have the foot held upright, or, better still, rotated slightly inward, for it is only in this position that the neck will cast a shadow which gives a fair estimate of its size. In certain cases of this series beef-bone screws were used for fixation, after the neck and head

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were carefully prepared. It was found in a previous series that they are not as suitable as the autogenous graft, as they are absorbed more quickly and do not stimulate the formation of bone. They have not been used in the clinic during the last few years, although they have a definite place in the treatment of fresh fractures.

When the neck has been absorbed, Brackett's operation is an excellent procedure, if the patient is young enough and providing at operation the head is found to be not devitalized or necrotic. A good portion of the trochanter with its attached muscles is lifted up, and a new neck is made, freshened, and carefully fitted to the reshaped head of the femur, and the hip abducted. The trochanter is then fastened to a new area which has been carefully freshened on the femur at a lower level and the leg put up in plaster well in abduction (Fig. 2).

For older persons with the same degree of absorption of the neck and in whom the condition of the head is a little more doubtful, it is preferable to use some form of operation that demands removal of the head and placing the upper end of the remodelled femur in the acetabulum for skeletal support. This method is quicker, and therefore, better for the elderly patient who is subjected to the operation chiefly to relieve pain. Whitman's operation consists in lifting up the trochanter with its attached muscles, removing the head of the bone, reshaping the upper end of the femur and placing it in the acetabulum (Fig. 3). The trochanter, as in Brackett's operation, is fastened to the femur at a lower level, and the leg is put up well in abduction in a plaster-of-Paris cast. Albee has recommended much the same procedure, except that, after removal of the head, he merely splits longitudinally downward through the trochanter well into the substance of the shaft of the femur, pries the trochanter and its attached muscles outward, by a sort of green-stick fracture at the base of the outer portion, and places in the acetabulum the inward, unfractured part of the split which he rounds off (Fig. 4). The leg is put up into abduction and held there in a cast. The Lorenz bifurcation operation has also been recommended to furnish skeletal stability, but I have had no experience with it in cases of fracture of the hip.

Review of Cases.—From January 1, 1919, to December 31, 1925, inclusive, 175 patients with fracture of the neck of the femur were examined in the

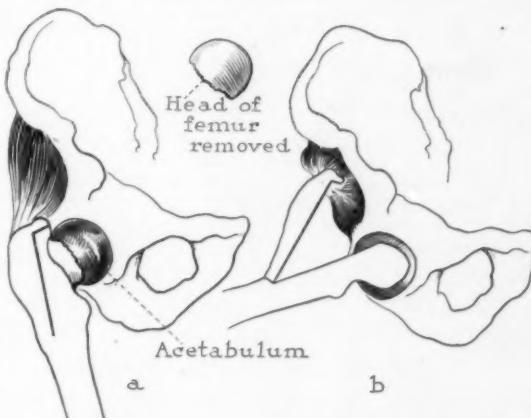


FIG. 4.—Reconstructed upper end of the femur placed in the acetabulum after the removal of the head.

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Mayo Clinic (Table I). Twenty-one of these patients had fresh fractures, so are not considered in this study; thirty-one came complaining of painful hips, but union seemed complete or nearly so and no treatment was recommended; and ten patients had pathologic fractures due to syphilis, osteomy-

TABLE I

*Cases of Fractures of Neck of Femur at Mayo Clinic
Between January 1, 1919 and December 31, 1925*

Type of fracture	Cases
United, with arthritis, pain, and so forth.....	31
Non-union, operation not advised (old age).....	66
Non-union, pathologic.....	10
Recent.....	21
Non-union, operation advised but not performed.....	12
Non-union, operation performed*.....	32
Mal-union.....	3
total.....	175

ritis, or bone tumors; thus the number of patients that could legitimately be considered for surgical treatment was reduced to 113.

However, most of the 113 were not considered suitable for surgical treatment, as only thirty-five (31 per cent.) were operated on; thirty-two (28.3 per cent.) for non-union of the neck of the femur, and three (2.7 per cent.) for mal-union. Of the seventy-eight patients (69 per cent.) who did not receive surgical treatment, there were twelve for whom operation was advised, but for various reasons was not carried out and sixty-six for whom operation was not advised because of old age, debility, slight disability, and so forth. This type of operation entails a long stay in hospital, and when the facts are fairly presented some patients are unwilling or unable to make the sacrifice.

TABLE II
Results of Operation for Non-union of Neck of Femur

Operation	Not known	Not cured	Cured
Bone graft.....	2	5	16
Beef bone.....	0	0	3
Brackett.....	0	0	2
Whitman.....	0	0	4
Whole group.....	2	5	25
			83 per cent. cured.

Therefore but thirty-two patients received treatment for non-union of the neck of the femur. An analysis of the various types of operations performed and the results obtained is of interest. Taking the group as a whole, regardless of the means employed, a satisfactory result was attained in twenty-

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five instances. That means that the patients were enabled to discard all supports such as crutches and canes, and again take part in their ordinary social and business activities. Some, it is true, had a slight limp and a certain degree of stiffness, but all concerned were satisfied.

A study of the results shows that there were no real failures except from the bone grafts (Table II). It must be remembered, however, that the aim in

TABLE III

Patients Operated on for Non-union of the Hip From January 1, 1919 to December 31, 1925

Age, years	Sex	Duration of non-union, years	Operation	Cure	Failure	Not traced
53	F	0.5	Graft from fibula	o	+	o
45	F	0.75	Beef bone screw	+	o	o
41	M	0.5	Beef bone peg	+	o	o
			Graft from fibula			
44	M	0.5	Beef bone screw	+	o	o
30	F	0.75	Graft from fibula	+	o	o
35	F	0.5	Graft from fibula	+	o	o
53	M	0.5	Graft from fibula	+	o	o
37	M	1.0	Graft from fibula	+	o	o
49	F	1.0	Brackett	+	o	o
18	F	3.0	Brackett	+	o	o
28	F	3.5	Graft from fibula	o	o	+
58	M	1.5	Graft from fibula	+	o	o
52	F	0.5	Graft from fibula	o	+	o(death)
53	M	1.0	Graft from fibula	+	o	o
21	M	1.5	Graft from fibula	+	o	o
58	F	1.0	Whitman	+	o	o
55	M	2.0	Graft from fibula	o	+	o
35	M	1.5	Graft from fibula	+	o	o
46	F	1.5	Plastic. Beef bone screw	+	o	o
40	M	2.0	Graft from fibula	+	o	o
47	M	0.5	Graft from fibula	o	+	o
40	M	0.5	Graft from fibula	o	+	o
50	F	0.5	Graft from fibula	+	o	o
52	M	3.0	Graft from fibula	+	o	o
39	F	2.5	Graft from fibula	+	o	o
32	M	1.0	Graft from fibula	+	o	o
54	F	1.5	Whitman	+	o	o
52	M	1.0	Graft from fibula	+	o	o
49	F	2.0	Graft from fibula	+	o	o
46	F	4.0	Whitman	+	o	o
68	F	3.0	Whitman	+	o	o
44	F	2.0	Graft from fibula	o	o	+

this type of operation is much higher, a more or less anatomic restoration being carried out; the technic is correspondingly difficult.

The sexes were about evenly divided, there being seventeen females and fifteen males. The ages ranged from eighteen to sixty-eight years; one girl was eighteen, two patients were between twenty and twenty-nine, six between thirty and thirty-nine, eleven between forty and forty-nine, eleven between fifty and fifty-five, and one woman was sixty-eight. The duration of the non-union varied from four months to four years. Fifteen patients had had non-union more than eighteen months, eight more than two years, five more than

MELVIN S. HENDERSON

three years. Of the last group the Whitman operation was used in two, in one the Brackett operation, and in two the bone-graft operation. In one of the latter the result is not known, but in the other case (a man aged fifty-two) the result was practically perfect. It was difficult to assign a definite cause for the non-union in each case, but, as is usual in this condition, the prime cause was lack of treatment, or, at best, treatment only for sprains, and so forth, at the time of the accident because no diagnosis was made. The next most important cause was the carrying out of poorly planned or poorly controlled treatment. There are now sufficient reports in the literature to establish the fact that the large majority of recent fractures of the hip will unite if logically treated by the abduction method.

There was one death, in the case of a healthy woman, aged fifty-two, following a well-executed bone-graft, as was shown at necropsy. This operation has naturally been classed as one of the failures, but, had it not been for the distressing accident of a cerebral embolus, union might reasonably have been expected. The embolus, a small one, evidently arose in the common iliac vein, travelled to the heart, and found its way through the patent foramen ovale to the brain. The patient became unconscious soon after awaking from the anæsthetic, and died two days later.

Calcium and phosphorus studies were made on some patients, but the findings were not conclusive.

SUMMARY AND CONCLUSIONS

The autogenous bone-graft, wherein the aim is to restore as nearly as possible the normal condition, is the operation of choice, and the fact that success was attained in 76 per cent. of twenty-one cases indicates that it compares favorably with the bone-graft for non-union in other bones. In three cases the same happy result was accomplished by using the beef-bone screws, but these cases were more favorable in every way. The remodelling operations of Brackett and Whitman were carried out in six other cases with good results in all. In the latter group, however, there was more residual stiffness than in the former group, and function, although satisfactory, was by no means as good. The duration of the non-union is no criterion in selecting the type of operation. Some of the best results followed the anatomic type of operation, using the bone-graft, when non-union had existed for two and one-half and three years.

The autogenous bone-graft should be used in cases of non-union of the hip when the patient is in good health, when the disability is considerable, and when enough of the neck of the femur is left. One cannot state what the maximal age should be for this operation, but it is my opinion that if the patient is more than fifty-five, one of the other types of operation, such as that advocated by Brackett, Whitman or Albee, should be employed. Each

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patient is an individual study not only as concerns the local condition, that is, the condition of the neck of the femur and the femoral head, but also the general health, age, social status, degree of disability, suffering, and so forth.

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TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting Held January 27, 1926

The President, DR. WALTON MARTIN, in the Chair

SEPTIC ARTHRITIS OF KNEE

DR. CHARLES E. FARR presented a girl, six years old, who entered St. Mary's Free Hospital for Children, May 12, 1925, and is still resident there. She had been run down and knocked over by an automobile immediately before admission, sustaining a compound, comminuted fracture of the right femur about the middle third, with a complete loss of skin over the mid-thigh to the lower third of the leg. A bridge of skin two inches wide passed across this gap, but was completely lifted from the underlying structures and was evidently sure to slough. The shock was so extreme that amputation was inadvisable, and on the other hand, the muscles, nerves, and vessels were normal and intact. After careful deliberation it was decided to try to save the extremity. A thorough débridement was carried out, a pin passed through the os calcis for traction, and Dakin's irrigation instituted. In addition various supportive measures for shock were carried out. The child rallied feebly, and a severe infection set in. The skin sloughed widely and general sepsis ensued of the streptococcus non-haemolytic type. This was combated in the usual way with supportive measures and transfusions.

About the thirteenth day the opposite knee became involved in an acute septic arthritis. After observation for five days this knee was widely opened on either side by Doctor Freeman, and a large amount of pus containing the non-haemolytic streptococcus evacuated. No drains were placed, only a small dressing was applied, and vigorous attempts were made to induce active motion. This was carried out by tickling the sole of the foot, causing the child to flex the knee to the point of pain. Then by gentle traction the leg was again extended. There was slow but steady progress in the use of the joint, and it healed in a comparatively few weeks. The general sepsis had subsided. Union eventually occurred in the fractured femur with considerable loss of bone and moderate bowing. A very large surface remained for skin grafting. This was carried out in stages and eventually was completely successful.

Flexion and extension of the infected joint are now normal. Weight-bearing causes no symptoms. There is a barely perceptible soft creaking, but no other remaining evidence of synovitis. This is the seventh consecutive case of septic arthritis of the knee in children which the reporter had treated in this manner. Of these six have given perfect results, and one only, in whom active motion could not be induced, resulted in a permanently stiff joint.

BOWEL INFLATION FOR INTUSSUSCEPTION

DOCTOR FARR presented a male infant, seven months of age, who entered St. Mary's Free Hospital for Children, October 15, 1925. He was a breast-fed child in the most robust condition and with no past illness and no relevant family history.

CONTUSION OF THE ABDOMEN

Present illness began forty-eight hours before admission with a history typical of intussusception. He had colic, vomited repeatedly, had one normal stool which was followed by a small stool of mucus and blood. The child was in marked shock, and vomited at intervals. There was a little blood in the rectal mucus and a mass could be felt in the left lower quadrant.

The child was anaesthetized with ether, the nozzle of a Davison syringe inserted in the rectum, and the colon inflated with air. This procedure was carried out on the operating table during the course of preparation for laparotomy. The mass in the left lower quadrant rose to the left upper, passed across the epigastrium to the right upper, and then to the right lower quadrant. Here it seemed to disappear and a fairly careful examination under the anaesthetic failed to reveal any further evidence of a mass. The abdomen was then opened with a split right rectus incision, and the only findings were very marked congestion and oedema of the lower ileum, the cæcum, and the ascending colon. The appendix was very hemorrhagic but was not removed. The ileum was considerably distended with gas but no further lesions were found and the abdomen was closed. The child was in considerable shock for the first twenty-four hours, then rallied well and left the hospital at the end of two weeks in excellent condition. The wound healed by primary union. The usual ileo-colitis yielded promptly to a proper diet.

DOCTOR FARR remarked that the reduction of the distal portion of an intussusception, especially of long standing, consumes more time than is warranted in these shocked little patients. One must either manipulate with the finger in the abdomen rather blindly, losing considerable time and increasing the shock already present, or must eviscerate and cause greatly increased shock. The procedure of air inflation is done during the giving of the anaesthetic. It requires but a moment, causes no shock, and at once relieves a large portion of the bowel from the pressure on its circulation. In this particular case the intussusception was entirely reduced, but it would be highly unwise to rely upon such a result as a rule. It at once shortens the operation by about one-half, and lessens the shock to a very marked degree. The use of air rather than water is recommended because air is completely elastic and can scarcely do any damage, and because it will instantly leave the bowel through the rectal tube on relaxation of the pressure on the syringe. This further aids in the performance of the laparotomy.

This or a somewhat similar procedure he had now used in three cases with excellent success, two complete reductions and one partial. The use of enemata for the reduction of intussusception is very old and would still be justifiable in circumstances prohibiting a laparotomy. It would hardly suffice in an intussusception of the small bowel. The use of a barium enema for diagnostic purposes as well as partial reduction of the intussusception has also been tried with success.

CONTUSION OF THE ABDOMEN

DOCTOR FARR presented three cases of contusion of the abdomen.

CASE I.—A man, forty-six years of age, entered New York Hospital, service of Doctor Gibson, November 19, 1925. He had been struck in the left lower abdomen by the pole of a wagon four hours before admission. There was very severe pain immediately with profuse sweating. Twenty minutes later he vomited a half cup full of blood, and had a profuse cold sweat. The pain by degrees gradually became localized in the left lower abdomen. When admitted pain was confined only to this spot and was

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produced only by movement. He was a robust man evidently in considerable pain. There were no respiratory signs nor symptoms. Examination was negative except for the left lower quadrant where there was extremely marked tenderness and rigidity. His pulse was 76, and his temperature 98.8/10, his respiration was 20, his blood-pressure was 130 over 80. One hour later it was 126 over 84. Two hours later 135 over 80, and again two hours later 128 over 66. His leucocyte count was 6500 on admission with 76 per cent. polymorphonuclears. Four hours later it was 12,000 with 85 per cent. polymorphonuclears. The following day it was 14,000 with 88 per cent. polymorphonuclears. Urinalysis on admission showed a trace of albumin, a very faint trace of sugar, granular casts, leucocytes, epithelial cells, and urates. On the following two days urinalyses were practically negative. Two hours after admission his pulse had dropped to 72, his respiration to 18, his temperature had risen to 101.2/10. There was no vomiting and the history of bloody vomitus was not confirmed.

The man seemed to be rather severely injured. He was extremely tender and rigid in the left lower abdomen, his temperature and blood count rose, but his pulse, respiration, and blood-pressure did not go up correspondingly. The tenderness seemed more localized. It was determined to await events. During the next forty-eight hours there was a gradual subsidence of all symptoms, and on the fourth day he was allowed to go home. He was kept under observation by his family physician and made a perfect recovery. A moderate soreness in the left lower quadrant persisted for several days, evidently due to the condition of the abdominal wall, but at no time did any evidence of internal injury develop.

CASE II.—*Traumatic Rupture of Spleen.*—A man, thirty-four years of age, entered New York Hospital, November 27, 1925, having received a blow by a barrel which had fallen about thirty feet, striking his head and left shoulder, apparently a glancing blow. He was not completely unconscious but there was severe pain in his chest, back, and abdomen. The pain seemed to be increasing. There was no vomiting. His past history was negative except for a chronic productive cough. He thinks he had pneumonia, but never saw a physician. He was evidently quite ill but not apparently in immediate danger. He was poorly developed, slightly emaciated. He had a small cut beneath his left ear and another across the bridge of his nose. He had several discolored areas over his left shoulder and body. His respiratory movements were slightly restricted but otherwise normal. There was possibly diminished breathing at the left base. Coarse râles were heard over the whole of his chest, seemingly from his larynx or trachea. There was slight but definite tenderness and rigidity of the left abdomen.

On admission his temperature was 102.6/10, pulse 84, respiration 24. His blood-pressure at that time was not recorded. Within an hour it was taken and read 30 over 18. His pulse at this time was so rapid it was almost uncountable and had very little volume. His leucocyte count was 14,000 with 78 per cent. polymorphonuclears. After the operation it rose at once to 28,000 with 92 per cent. polymorphonuclears. His urine showed only a few leucocytes, otherwise it was negative.

He was operated upon immediately through a left rectus incision, with a right angle extension toward the spine. The abdomen was full of recent and older clotted blood. The spleen was torn extensively from the hilum and was bleeding very freely. It was removed. A small portion of the blood was aspirated. The wound was closed without drainage. During this time the patient was in a condition of extreme shock. An infusion of saline was given.

CONTUSION OF THE ABDOMEN

At the end of the operation his systolic blood-pressure was 83, and his pulse was barely perceptible. His condition seemed desperate and proctoclysis and bandaging of the three extremities were resorted to. The patient rallied fairly rapidly, but had a very sharp reaction reaching a temperature of 103-4/10 and a pulse of 136.

On the eighth day he gave the signs and symptoms of pulmonary embolism, coughed up bloody sputum, had pain and a temperature reaction. In the next few days he had eight or ten more pulmonary emboli. From the thirty-fifth post-operative day his temperature was normal, but he had a productive cough with blood-stained sputum. His skin reaction to old tuberculin was positive, but no tubercle bacilli could ever be found on repeated examinations.

CASE III.—*Ruptured Jejunum.*—A man, forty-one years of age, entered New York Hospital, December 17, 1925, in the service of Dr. Charles L. Gibson. Three hours before his admission he had fallen ten feet, landing on a beam on his abdomen. He was not unconscious, did not vomit, but complained of severe pain in the chest and abdomen, and of extreme tenderness. There was no bleeding from the mouth nor from the rectum. He immediately passed urine spontaneously and it contained no blood.

Although he gave a history of a perforated gastric ulcer four years before this accident and he had also had enteric fever and pneumonia, he was a very robust man, apparently in perfect health. On admission to the hospital his pulse was 80 and dropped to 72. His respiration was normal and remained so throughout. His temperature was normal. There were a few abrasions on the pubis and thighs and marked tenderness in the left and right lower chest in front, and very marked rigidity of the entire abdomen with no special spot of tenderness. The patient appeared in excellent general condition with good strong pulse, good color and smiled when talked to, although he said he was in extreme pain. His blood-pressure on admission was 135 over 90. One hour later it was 120 over 70, and one-half hour later still 120 over 70. The leucocyte count was 12,000 with 76 per cent. polymorphonuclears, and in an hour it had risen to 22,000 with 88 per cent. polymorphonuclears. His urine was normal except for a few leucocytes and doubtful red cells. An X-ray picture of the abdomen revealed no free gas in the peritoneal cavity.

At the end of one and a half hours of observation, his pulse had risen to 80, there was still marked rigidity and complaint of great pain in the abdomen without localization, an increased blood count, and a slight drop in blood-pressure. Although his excellent color and quality of pulse, no vomiting, no passage of blood, no free gas in the peritoneal cavity, no localized spot of tenderness, would have warranted a waiting policy the safer course seemed to be an exploration, with the tentative diagnosis of rupture of a viscus. Under ether narcosis the old scar for gastric perforation was reopened. A few omental adhesions were found, the abdomen proved to be filled with recent and old blood and a very moderate amount of fluid faeces. There was absolutely no gas as determined by the Gibson Water Test on entering the peritoneal cavity. The first loop of bowel presented was the upper ileum or lower jejunum. It was torn nearly completely across transversely. It was no longer bleeding. There was very slight fecal leakage. The entire bowel for a considerable distance had nearly completely collapsed. This tear was at once repaired with fine chromic catgut. A search was then carried out from the ileocaecal valve to the end of the duodenum. A second tear in the bowel exactly similar to the first was found in the jejunum two or three feet above the first lesion. This was repaired with chromic catgut. The lacteals were

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markedly engorged but there seemed almost no fluid residue in the bowel, and no gas. Very careful examination of the entire abdomen revealed no evidence of further injury. The pelvis was filled with fluid blood and a little fecal material. This was found also scattered throughout the abdomen and was removed with an aspirator. The stomach was apparently intact, showing no evidence whatever of the old perforation, except a few fine adhesions around the duodenum and the spleen. The abdomen was closed in layers without drainage. The patient left the operating table in excellent condition and with a pulse of 92.

The wound healed by primary union, although the patient developed a mild post-operative pneumonia.

GASTRO-MESENTERIC ILEUS

DR. CHARLES L. GIBSON presented a man, age twenty-seven years, who was admitted to the New York Hospital, June 17, 1925. He gave a history of epigastric pain and distress over a period of two years, and vomiting and other signs of pyloric obstruction for a period of two months. Fluoroscopic examination showed a dilated stomach and duodenum with twenty-four-hour retention, and obstruction apparently at the apex of the duodenum. At operation a band was found which constricted third portion of the duodenum, causing a marked dilatation. Since the band contained the superior mesenteric artery, it was impossible to divide it, so a posterior no-loop gastro-enterostomy was done.

Except for some vomiting on the first post-operative day, convalescence was uneventful. He was discharged on the thirteenth post-operative day, in good condition; the wound healed. Three months later, he had been eating everything and had gained about twenty pounds.

Six months later: Excellent condition. Has held his twenty-pound gain in weight.

CASE II.—DOCTOR GIBSON presented also a man, age twenty years, who was admitted November 15, 1924, with a history suggestive of appendicitis. Appendectomy was performed; but showed little if any pathological condition.

One month later he was readmitted on account of intense and continuous pain in lower abdomen, increasing in severity. Vomits also quite frequently, usually a half to an hour after meals.

A fluoroscopic examination resulted in a diagnosis of post-pyloric ulcer.

At operation, a large distended stomach and duodenum, as far as third portion, found. No apparent ulcer could be made out. The duodenum was sharply obstructed at the site of the superior mesenteric artery. A posterior gastro-enterostomy was done.

He made a good convalescence. On discharge, condition greatly improved. Pain and epigastric distress entirely relieved.

Three months later: Stomach in fine condition. Can now eat all kinds of food.

A year later: Excellent condition. Eats all kinds of food with no discomfort.

DOCTOR GIBSON remarked that these patients were operated on and are reported with a full appreciation that the operation of gastro-enterostomy in such conditions is considered by many, perhaps most, authorities as not the most suitable operation.

GASTRO-MESENTERIC ILEUS

Duodenostomy and duodenojejunostomy have been the operations which have been generally recommended to perform. There is, however, a rather suspicious lack of convincing end results quoted to back up this practice. In addition to these operations, other procedures have been employed, some of them apparently quite foolish, as for instance resection of the ileocaecal coil.

If one looks upon the alimentary tract simply as a diagram, the gastro-enterostomy is open to objection; but one must remember the changes that come in any stenosed tube after deviation of its habitual contents; for instance, relaxation of the oesophagus after gastrostomy, and the permeability of a tight urethral stricture after external urethrotomy. Moreover, the obstruction in this case is by compression and not an organic stenosis, and it does not require much space to allow for passage of normal fluid contents of the duodenum; that is the pancreatic juice and bile.

His objection to duodenostomy and duodenojejunostomy was that the late results in that such operations seem to have more possibilities of subsequent trouble from distortion, shrinkage and adhesions. They are also harder to perform.

It is most important to consider the possibility of duodenal stenosis by compression of the superior mesenteric artery in doing certain operations which do not provide indirect drainage of the stomach, such as pyloroplasty, gastropasty and the Billroth No. 1 type of resection. Harberer has reported three cases of Billroth No. 1 requiring re-operation on account of this condition; Finney two cases after his pyloroplasty.

He had recently had a third case, an hour-glass stomach, in which this complication, compression of the duodenum, existed. The case, however, is of too recent a date to report, although up to this time she has been very well following a gastro-enterostomy in the main proximal pouch.

Dr. JOHN DOUGLAS said that it was difficult to see why gastro-enterostomy relieved the obstruction. As a contribution to the subject, he showed some radiographs of a case recently operated on at St. Luke's Hospital. This was a man who came to the hospital the latter part of last May with a diagnosis of duodenal ulcer. He was operated on on June 1 and an indurated ulcer was found. Gastro-enterostomy was done with no soiling. For six days his recovery progressed uneventfully; there was no vomiting and no rise of temperature. On the seventh day he started to vomit and this continued. The stomach was washed out but with little result. On the 12th day of June a plain X-ray plate was taken, which gave no information. June 17, a series of radiographs were taken after ingestion of barium. The stomach was shown to be distended with a very much distended duodenum, to where the gastro-mesenteric ileus occurs. The radiographs show apparently nothing going through the stoma. It seemed difficult to know what to do, but apparently the gastro-enterostomy was not working. So the wound was opened under local anaesthesia and a large number of adhesions found, but the gastro-enterostomy seemed to be all right; it was possible to put two fingers

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through the opening. As the stomach had been thoroughly lavaged before operation, there was nothing in the stomach or duodenum. The adhesions seemed to have been the cause of the obstruction, and it was hoped that these having been separated, the ileus would be relieved, but a duodenal tube was passed from the mouth and brought into the distal loop of the jejunum with the idea of feeding him through that. There was no vomiting for a few days, but on aspiration some bile was obtained on the third day after the second operation and he started to vomit and burst part of the wound open, and something, either stomach or intestinal wall, was projected. He was opened up again and more adhesions found and the viscus that was projecting was found to be part of the stomach wall. The jejunum was distended and there was local peritonitis around that area. At this time a jejunostomy was done. He was in bad condition, with a blood urea of 65, and he died the following day. The obstruction was due, probably, to contamination, perhaps from some leakage from the original ulcer, which caused dense adhesions in this region. In such cases of so-called vicious circle, if found early by X-ray, it might be possible by duodenojejunostomy to relieve the condition, when the obstruction is at the duodenojejunral angle, as is sometimes the case, as the ordinary jejunostomy would be of no avail.

DR. WALTER M. BRICKNER related the history of a young married woman with gastrophtosis who had been vomiting for about eight years and had become much emaciated. Fluoroscopy showed dilatation of, and retrograde peristalsis, in the duodenum. No relief had been obtained with medical treatment. Operation revealed obstruction at the duodenojejunral angle and very evident dilatation of the duodenum. In addition there were some adhesions between the duodenum and the gall-bladder, but the latter was otherwise apparently normal. Duodenojejunostomy was easily performed and gave prompt relief. The patient gained steadily in weight and ceased vomiting. Seen recently, two years after the operation, she is in excellent health and has no vomiting or other symptoms.

DR. ALFRED S. TAYLOR said it was not a logical procedure to do a gastro-enterostomy for obstruction at the end of the duodenum. With regard to the statement that there is no authentic case of cure from duodeno-jejunostomy, Kellogg has reported several, in fact, a series of 40 to 150, in a large number of which the results have been very good. The speaker said he had had cases where there was chronic duodenal obstruction in which duodenojejunostomy did very well. It seemed to him that one ought to be clear as to which method to choose, but personally he preferred duodeno-jejunostomy to gastro-enterostomy.

DR. HERMANN FISCHER said that he had occasion to operate in two cases for a duodenal obstruction at the duodenojejunral angle. The first patient was a woman which the speaker had presented to the Society several years ago. She had been in the medical ward for observation on account of continuous occult hemorrhages resulting in a severe secondary anæmia. X-ray examina-

CYST OF PANCREAS

tion of gastro-intestinal tract did not reveal the site of the lesion. Finally an exploratory laparotomy was done for a suspected carcinoma of the colon. The lesion was found at the duodeno-jejunal angle. It was a tumor of a probable inflammatory nature in consequence of a jejunal ulcer. A duodeno-jejunostomy was done with good immediate effect. The occult hemorrhages stopped for several months. The subsequent course of the disease, however, was unfavorable. The lesion was probably a carcinoma, for she died very cachectic about one year after the operation.

The second patient suffered from a carcinoma of the pancreas which had invaded the retroperitoneal tissue and caused an obstruction at the duodeno-jejunal angle. A duodeno-jejunostomy was done. The patient who was in very poor condition did not rally from the operation and died two days after the operation. In obstruction of the duodenum at the duodeno-jejunal junction, duodeno-jejunostomy should be done instead of a gastro-enterostomy.

DOCTOR GIBSON, in closing the discussion, said that in these cases the obstruction could not be described as at the duodeno-jejunal angle. There exists a difference of opinion in regard to the proper operation to be performed, but he has not found the results of duodeno-jejunostomy to be so brilliant as they are described. He realized perfectly that gastro-enterostomy was not the logical operation in these cases, but the fact remains that they have been relieved of their symptoms after suffering very acutely.

CYST OF PANCREAS

DR. JOHN M. HANFORD presented a man, aged thirty years, who was admitted to the Presbyterian Hospital, March 7, 1924, with the following history partly obtained by a letter from a surgeon who had previously operated upon him:

December 21, 1923, he was injured in an automobile accident and was taken to a nearby hospital. He was unconscious for the first twenty-four hours. He then began to vomit. Vomiting continued, together with pain in the upper abdomen, and then subsided, but recurred. There were evidences of fluid in the abdomen. He was operated upon about five days after the injury. The findings of this operation are reported to have been: Free blood in the peritoneal cavity, an adhesion of the transverse colon to the pylorus, and bleeding from the pyloric vein upon separating this adhesion. This is thought to have been the source of the bleeding. A small tear in the spleen was suspected, but on account of his poor condition it was not explored.

During convalescence from this first operation he again started vomiting, and it was thought that he had distention of the stomach without general abdominal distention.

On entering the Presbyterian Hospital he said that he had had vague discomfort in the left upper quadrant and slight prominence of the abdomen since leaving the former hospital. A week before admission to the Presbyterian Hospital he had had severe pains in the left upper quadrant during and following the taking of food; enlargement of his abdomen began to increase rapidly; and on the day of admission he vomited a little green fluid. He complained of numbness in the right upper limb since the injury.

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He was a poorly nourished, chronically ill appearing young man. There was marked bulging and prominence of the abdomen rather more to the left than the right and more in the upper than in the lower abdomen. There was a recent right rectus scar with three small granulating areas in it. There were no visible pulsations. Palpation revealed abdomen generally tense. A fluid wave was present. There was tympany in the right flank and in the right lower quadrant and dulness in the left flank and left upper quadrant with little change on change of position. The splenic dulness appeared increased, but neither spleen nor liver were felt. Succussion sound was obtained in the anterior upper part of the abdomen.

The temperature, pulse and respiration were normal. The blood count, urine and blood Wassermann were all normal. Plain X-rays of the abdomen in the supine and lateral positions showed: "A shadow which might be due to a cyst or tumor in the upper abdomen."

The gastro-intestinal X-ray examination showed: "The left diaphragm slightly elevated. A gas bubble not in contact with the diaphragm as it usually is. The stomach flattened against the anterior abdominal wall." The röntgenologist indicated that there might be something pushing the stomach forward from behind.

Operation. March 15, 1924.—On opening the peritoneal cavity the stomach presented and appeared normal except that it was low in position and rather flattened antero-posteriorly. There was no free fluid in the general peritoneal cavity. Exploration of the general cavity was difficult because of the extreme tenseness of the fluid in the lesser sac. On exploring further it was found that the lesser omentum was tense and bulging forward and fluctuated. An aspirating needle was inserted about 2 or 3 cm. above the lesser curvature of the stomach and watery turbid fluid was withdrawn. Through the needle puncture more fluid spurted out, so that a larger opening was made and a sucker inserted. There must have been about 5 litres of this fluid completely distending the whole lesser sac. The lining of the sac on thorough investigation appeared normal except for three things: (1) Obliteration of the foramen of Winslow. (2) A varicosity on the anterior surface of the left renal vein in front of the vertebra. (3) A 4 cm. tear in the peritoneal surface just behind the middle of the lesser curvature of the stomach.

On tracing with a probe into this tear no opening in the stomach wall could be detected. There was no evidence here of inflammation. It is possible that this tear may have overlaid the varicosity and that at the time of the injury both lesions were produced. The fluid was more like that of a transudate than of an inflammatory exudate. Yet it is hard to understand the obliteration of the foramen of Winslow. Adhesions between the great omentum, the right border of the lesser omentum and the anterior abdominal wall prevented exploration of the gall-bladder and the whole upper right side of the abdomen. The pancreas felt soft and normal but was displaced downward apparently by the tremendous distention of the lesser sac. The fluid from the lesser sac was all aspirated. Exploration further revealed the boundaries of the lesser sac to be those of a sacculated collection of fluid. The wound was closed, leaving a Penrose tube of a soft rubber dam drain in the lesser sac through the opening in the lesser omentum.

The pathologist reported that the bit of tissue removed from the lining of this sacculated cavity showed dense connective tissue with swollen collagen fibrils, and lining membrane apparently composed of atrophic connective-tissue cells and very little inflammatory reaction.

CYST OF PANCREAS

An examination of the fluid obtained revealed a cell count of 163 per c.c. with a differential count of 60 per cent. polymorphonuclears and 40 per cent. lymphocytes. It contained minute amounts of amylase, protrase, sodium chloride, and sugar.

After the first two days very little leakage occurred from the wound. Ten days after operation there was a definite recurrence of the swelling in the left upper abdomen and he complained of a sense of fulness after eating, some pain in the left upper abdomen, and belching of gas with relief. The same physical signs were again obtained and repeated examination of the gastro-intestinal tract revealed much the same finding as before.

March 29, 1924, two weeks after the first operation in the Presbyterian Hospital, he was again operated upon, going through the upper part of the recent wound.

Much the same findings appeared. The omentum was opened and three litres of turbid straw-colored fluid was aspirated. This fluid was more turbid than on the preceding operation. This time, instead of using soft rubber tubing of the rubber dam type, ordinary rubber tubing was used, one tube passed behind the body of the stomach downward, and the other behind fundus toward the left.

Culture of this fluid showed *staphylococcus aureus* and it contained amylase, protease and lipase in very small amounts. It did suggest pancreatic secretion.

Following this second drainage of the lesser sac, the man felt better. He still had some pain in the left upper quadrant and digestive symptoms after eating, but at no time since then has swelling of the upper abdomen appeared. Leakage of clear pale watery fluid, occasionally containing lipase, continued in varying amounts for several months.

May 6, 1924, he was discharged from the hospital apparently improved but still draining fluid.

Closed permanently four and a half months after second operation.

CASE II.—The patient, an adult woman, came to the Presbyterian Hospital, August 14, 1925. Six years previously she had been ill for four weeks with severe pain in the lower abdomen and rectum. She states that then something "broke" in her rectum quite suddenly and then she evacuated a large amount of pus with almost immediate relief of pain. For many years she had been constipated.

Her recent illness dated from June, 1925, when she began to have diarrhoea, followed by severe cramps in the abdomen, distention, and high fever. She was then acutely ill and these symptoms continued for about two weeks, after which she tended to improve.

A few days before admission she had a relapse of the same symptoms of fever, abdominal pain, vomiting, distention and prostration. She also had pain in her back and left upper quadrant. There had been absolutely no respiratory infection but just prior to admission she developed a pain in the right lower lateral chest, increased on deep breathing.

On admission the essential physical signs were as follows: There were signs of fluid at the lower posterior chest, but no change in position in the liver outline. Slight distention and definite resistance of the whole abdomen. Rigidity of the upper right quadrant. Pelvic examination normal. She was acutely ill, pale, sick, with rapid pulse of poor quality and high fever. Leucocyte count, 16,800. Polymorphonuclears, 87 per cent. Slight secondary anaemia. Urine normal. Examination of stool revealed no evidence of blood, ova or parasites. Pus was not reported but grossly stools appeared to contain much mucus with pus.

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Aspiration of the right lower pleural cavity behind yielded a little fluid containing polymorphonuclears, which suggested a nearby pyogenic infection. Her blood culture proved sterile.

Fluoroscopy and X-ray examination of the chest indicated a small amount of fluid in the right costophrenic angle but fluoroscopy suggested nothing to indicate a subdiaphragmatic abscess.

Operation Under Gas and Ether, August 16, 1925.—On opening the peritoneal cavity, through the right rectus incision, there was a small amount of slightly turbid free fluid. The great omentum was found on the superior aspect of the liver, over the right lobe, where it was adherent by fine fibrinous adhesions in the shape of a great flat disc, about 15 cm. in diameter. This disc was somewhat bluish, very indurated and apparently the site of acute inflammation. The pedicle of the disc was normal omentum. This disc of omentum was easily separated from the upper surface of the liver and under surface of the diaphragm, leaving slightly bleeding surfaces. The liver was otherwise made out normal. There was no suggestion of an abscess nor of multiple abscesses. It was but slightly if at all enlarged. There was no subphrenic accumulation. It was only after the displacement of this disc of omentum that the subhepatic space could be explored. The gall-bladder was nowhere to be found, but in its space lay a definite cystic mass which was at first thought to be an abscess. It lay rather deep in the posterior wall of the peritoneal cavity to the right of the duodenum and beneath the posterior part of the right lobe of the liver. After exploring this fluctuating surface it was aspirated, when perfectly clear fluid appeared in the syringe. It resembled spinal fluid. Having discovered that this was no abscess, it was left alone, and the exploration continued. Passing the hand down the abdomen a mass was found just below the umbilicus beneath the anterior abdominal wall. In exploring this mass, the finger entered a pocket and thick, foul-smelling, yellowish-brown pus appeared upon the examining glove. This evidently meant a localized, peritoneal abscess, just below the umbilicus. Passing the hand down the right lumbar gutter and toward the pelvis, nothing else could be found. There was apparently no evidence of appendicitis because the abscess seemed to have no connection with the right lower quadrant. It was thought possible that this was due to a Meckel's diverticulum or was an infected cyst of the urachus.

The peritoneal abscess was drained through a lower right rectus incision and a jejunostomy was done through a small wound in the left upper abdomen. The jejunostomy appeared indicated because of the evidence of an acute diffuse peritonitis, with distention and vomiting.

She was acutely ill for several days after operation, but except for the signs of a mild post-operative pneumonia, she was slowly but steadily improved.

Culture of the cyst fluid was sterile. No pancreatic ferments were present. Culture of the pus from the peritoneal abscess showed *haemolytic staphylococcus aureus*.

For a long time she continued to run a temperature of 99 to 101. She left the hospital September 15, 1925, and for two or three months subsequently continued to have slight fever and elevation of pulse. Her strength has increased and now she has occasional temperature of 99 with a slightly elevated pulse.

She still has the signs of what is thought to be thickened pleura at the right base. Her digestive tract is functioning satisfactorily except for slight tendency to constipation. There is a ventral hernia.

HIGH ENTEROSTOMY FOR ILEUS AFTER APPENDICITIS

This woman is now thought to have had a pseudocyst of the pancreas associated with a preceding acute atypical pancreatitis. She is to be frequently observed over a long period.

ADENOCARCINOMA OF SIGMOID COLON

DR. SEWARD ERDMAN presented a man, who was admitted to the New York Hospital, October 14, 1916, aged sixty-six years. The history ran back for half a year, during which time he had had occasional passage of blood and mucus by rectum. Occasional faint attacks and recently two attacks of obstipation with vomiting, with loss of weight and strength. Examination showed a nodular sloughing tumor hanging down in the mid-rectum, apparently invaginated from above.

October 30, 1916, an exploratory operation was performed which revealed the lower sigmoid invaginated into the upper rectum. This was easily reduced and a tumor was palpated in the sigmoid, measuring about 4 inches in diameter. The entire loop was drawn out of a left inguinal incision and the wounds closed about it. The Mikulicz method was followed. On the fourth day the loop was removed with the cautery. Later clamps were applied to the spur, and on December 6 the artificial anus was closed by Lembert sutures of the gut and simple closure of the skin under local anaesthesia. No attempt was then made to prevent a hernia. The wound rapidly closed, but a slight hernial protrusion has always remained.

The patient gained weight and has remained perfectly well for these nine years.

DR. CHARLES L. GIBSON remarked that he had a patient living thirteen years after a three-stage resection. At the time of operation 20 inches of gut were taken out and in the cut end of the meso there were cell nests found. The wound was kept open for four months and the cautery was used on the edges, which probably accounts for the patient being alive to-day. In another case large nodes were found which were carcinomatous. That man is alive and working seven years since the nodes were taken out.

HIGH ENTEROSTOMY FOR ILEUS AFTER APPENDICITIS

DR. SEWARD ERDMAN presented a woman, aged thirty-four, who was admitted to the New York Hospital, June 8, 1924.

Two and one-half days before admission, she had been ill with general abdominal pain, localizing in the suprapubic region, with fever (101) and persistent vomiting.

On admission both lower recti were rigid, and a pelvic mass was palpable.

First operation, June 8, an immediate laparotomy was performed through a right paramedian incision. There was free turbid fluid. A mass filled the pelvis, consisting of thick creamy pus with foul odor, forming an abscess about a sloughed appendix, which was bound to the back of the uterus. Appendix removed and wound lightly closed about two drains to the cul-de-sac. Culture showed bac. coli communis.

The post-operative course was very stormy, with high temperature, much distention and recurrent vomiting, and much purulent drainage.

Second operation, on the ninth post-operative day, after several days of obstipation, distention and continuous vomiting, a jejunostomy was performed under local anaesthesia. Drainage averaged over 600 c.c. daily for five days, with relief of distention and vomiting. The tube was removed after five

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days and the wound healed without any gross leakage. Some improvement was noted, but the temperature continued.

Third operation, on the twenty-first post-operative day (June 29), a posterior colpotomy was performed to relieve a low pelvic collection; but this did not drain well, and by rectum the abscess could be felt pointing into the lumen.

Fourth operation, on the twenty-fourth day, the pelvic abscess was drained through the rectum, and seemed to clear up the pelvic condition. However, the temperature continued and pain was complained of in the left hypochondrium. An X-ray on the twenty-eighth day showed a high left diaphragm, but aspiration with needle on this date failed to reveal the sub-diaphragmatic abscess.

Fifth operation, on the thirty-third day, a local abscess in the right iliac fossa was incised and drained.

Sixth operation, on the fifty-seventh day, after resection of a portion of the left tenth rib, a left subphrenic abscess of four ounces of pus was drained. Thereafter the general condition slowly improved, but purulent drainage persisted for a long time. The patient went home August 17, the seventy-eighth day. After one week, an abscess formed in the right flank lateral to the cæcum, and she was readmitted to the New York Hospital.

Seventh operation, on the eighty-eighth day (August 26), an abscess was incised and drained in the right lumbar gutter, and the patient was sent home September 12 with wounds granulating and suppuration over. Marked improvement and gain of weight set in and for six weeks the patient seemed well. Suddenly she developed acute intestinal obstruction and was admitted for the third time to the hospital.

Eighth operation (October 1), one hundred and twenty-two days after her first operation. The release of a kinked loop of ileum attached deep in the pelvis, relieved the obstruction and the patient went home October 16. Wounds healed.

May 30, 1925, she was admitted to the hospital for the fourth time. Eighteen hours before admission another attack of acute obstruction had developed.

Ninth operation, on the three hundred and fifty-seventh day, revealed an acute intestinal obstruction due to the catching of a loop of low ileum over a "shoe-string" adhesion band in the right lower quadrant.

At the last operation an opportunity was afforded to review the jejunostomy site from within. No adhesion was found to the parietal peritoneum, and only a small stellate cicatrix on the wall of the bowel at this point.

ANOMALOUS TUMOR OF THE CERVICAL LYMPH-NODES

DR. SEWARD ERDMAN presented a man, aged thirty-seven years, whom he saw first in April, 1924. He had a swelling of the lymph-nodes in the left side of his neck, which had been gradually increasing since he first noticed it, about one and one-half years before. For the past four months increase in size had been more rapid. He had had a mastoid operation in childhood. Occasionally he suffers from hoarseness. There were no other symptoms and he would have left the condition alone, except that he had recently been rejected for life-insurance. No loss of weight nor strength.

On the left side of the neck, about the level of the thyroid, there was a swelling without any inflammatory signs over it.

Palpation revealed a mass beneath the sterno-mastoid, slightly irregular in outline and measuring about 5 cm. in diameter, also several almond-shaped nodes could be felt extending down into the subclavian region.

ANOMALOUS TUMOR OF THE CERVICAL LYMPH-NODES

August 14, 1924, at the New York Hospital, the enlarged lymph-nodes were excised together with the gland-bearing fascia, from the level of the hyoid down to the clavicle.

There was no peri-adenitis and the discrete nodes were removed quite easily. The gross appearance was that of a chain of about eight lymph-nodes, several of which presented cystic bluish areas; and one seemed to be simply a thin-walled cyst.

Pathological Report.—Specimen consists of a mass, slightly lobulated, $5 \times 4 \times 2$ cm. (This being the upper and largest tumor.) Cut section has yellowish-white appearance, with some opaque areas and many cystic areas. The cystic areas measure from 1 mm. to 1 cm. in diameter and contain clear jelly-like (colloid) material.

Also a group of six other masses, varying from 1 to 3 cm. in diameter. On section they have an appearance similar to that described in the largest mass.

Also a thin-walled cyst, 2 cm. in diameter and filled with translucent jelly-like material of dark brown color.

Microscopic section shows the lymph-nodes to be almost entirely replaced by a tumor growth consisting of cystic spaces filled with colloid. The cysts are almost entirely filled by branching papillary projections of a fibrous stroma covered by a layer of polygonal cells which resemble epithelium. A similar epithelial-like layer of cells lines the cysts.

In some parts the epithelial cells grow in irregular sheets. Structures resembling epithelial pearls are found in some parts. In the stroma are structures filled with colloid-like material, which "resemble thyroid acini." (Fig. 1.)

Since operation, over one year and five months ago, the man has been feeling perfectly well. No loss of weight or strength. An X-ray of the chest taken January, 1926, "shows nothing that would indicate glandular enlargement or pulmonary pathology" (Belden). Examination of his neck

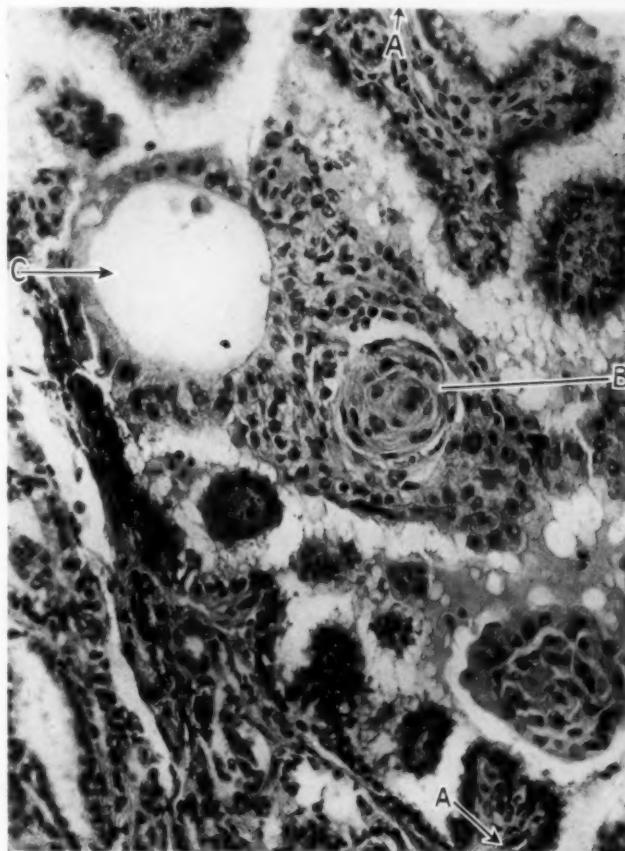


FIG. 1.—High power. Showing (A) branching papillary growths. (B) An epithelial pearl. (C) Colloid acinus resembling thyroid tissue.

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does not show any gland enlargement. In left axilla a small node is palpable, but probably is not significant.

Various pathologists have seen the sections and have ventured several different diagnoses.

(a) "Papillary endothelioma of lymph-nodes" was one of the first diagnoses, but the same pathologist has very recently revised this diagnosis, and now considers it—

(b) "A metastatic papillary adeno-carcinoma of the thyroid"; or

(c) "An adeno-carcinoma of aberrant island of thyroid tissue." Another pathologist suggests metastases of normal or hyperplastic thyroid. Another suggests "cell rests" in the lower branchial clefts.

In this case the most noteworthy feature was the entire replacement of the lymph-nodes by the peculiar tumor, also the unexpected presence of epithelial pearls.

Clinically the case does not appear to be malignant and the reporter inclined to the theory that it represents a peculiar tumor of developmental origin, rather than an adeno-carcinoma.

DR. EDWARD W. PETERSON said that he had a case similar to this which was pronounced an aberrant thyroid. Doctor MacNeil so pronounced it and made a note that it was potentially malignant. The patient had X-ray treatments and has had no trouble since, although that was nine years ago.

FRACTURE OF ACETABULUM

DR. CONSTANTINE J. MACGUIRE, JR., presented a man, fifty-two years of age, who was admitted to the First Surgical Division, Bellevue Hospital, October 24, 1925, suffering from a fracture of the left acetabulum with inward dislocation of the fragments and of the head of the femur as the result of a fall directly on the side of the hip. The left thigh was held in flexion, slight abduction and external rotation.

Under anaesthesia reduction could be effected but could not be maintained as the shattered acetabular fragments remained in inward displacement and consequently the femoral head would fall back into the defect into the pelvis.

Further attempts were refused by the patient for three weeks, when he finally consented to the introduction of a Steinman pin horizontally through the great trochanter. This was easily done and traction of twenty pounds applied from above with patient turned on his right side.

This kept the head of the femur out of the pelvis, but rectal examination showed that the acetabular fragments were still displaced and could not be bridged by digital pressure.

Traction was maintained for two weeks and then a plaster hip spica with the thigh abducted was applied. The Steinman pin was kept in place under traction until the plaster hardened. The plaster spica was kept on for four weeks and followed by massage and motion. At present, three months after injury, he has one centimetre shortening, slight limitation of external rotation and abduction and an almost imperceptible limp.

This case was shown as exhibiting a new use for the Steinman pin, namely for direct traction in the axis of the neck of the femur. It might be an aid in realigning the fragments in fracture of the neck of the femur before immobilization in the Whitman position where the Whitman procedure has failed (if ever) of satisfactory reduction.

ACUTE KNEE-JOINT INJURIES

FRACTURE OF BOTH PATELLÆ

DOCTOR MACGUIRE presented a woman, who on March 15, 1925, being then thirty-four years of age, was admitted to the First Division, Bellevue Hospital, with a transverse fracture of the left patella the result of direct violence, namely a fall on the knee with the leg in flexion.

The following day she gave birth to a full-term child. Two days later under local anaesthesia the usual operation was performed of suture of the extensive lateral tears in the capsule with chromic catgut. This closely approximated the widely separated fragments. Ten per cent. novocaine gave complete freedom from pain.

Motion was started in ten days and complete function was obtained in six weeks.

One year later she fractured the opposite patella, this time by indirect violence in an attempt by sudden extension to save herself from falling. A similar operation again under local anaesthesia was followed by complete recovery.

X-ray pictures taken six months later showed bony union in the second patella fracture, but fibrous union in the first.

This case was shown to illustrate the possibility of perfect function irrespective of bony union, as the coincidence of fractures from both direct violence and indirect violence in the same individual. He also called attention to the satisfactory use of local anaesthesia by simple infiltration when indicated as in this case by a complicating frequency.

ACUTE SUPPURATIVE ARTHRITIS

DOCTOR MACGUIRE presented a boy, who November 10, 1922, at that time, eleven years of age, was admitted to the First Surgical Division of St. Vincent's Hospital, suffering from an infected laceration of the right knee associated with elevation of temperature and rapid pulse. This laceration had been treated outside for a week previous to admission.

November 13, irregular rises of temperature to 103 degrees, pulse of 130 and septic appearance led to an aspiration of the knee-joint, which revealed purulent fluid which showed staphylococci and Gram-positive and Gram-negative bacilli.

Lateral incisions in the usual manner to the limit of the synovial cavity were made and active and passive motion started immediately post-operative. The day after operation the patient was forced to get up and walk about the ward. The temperature immediately fell to 99 degrees and never again reached 100. Complete extension during walking could not be accomplished by the patient for about six weeks, but by the second of January, 1923, full flexion and extension had been restored with only a slight limp. The inner opening had closed but the outer opening was still discharging a large amount of cloudy fluid, particularly evident during motion.

The boy was discharged as cured February 3, with both wounds closed and full function of joint.

ACUTE KNEE-JOINT INJURIES

DR. CONSTANTINE J. MACGUIRE, JR., read a paper with the above title, for which see page 651.

DR. SETH M. MILLIKEN said that the experience of Doctor MacGuire corresponded with his own and he agreed with all he said. The knee-joint does resist infection very well. He had a case with fracture of the thigh

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and the patella and when the knee-joint was opened there was flocculent serum in patella bursa which caused superficial infection of the knee-joint region without involvement of the joint cavity. The knee-joint has not been involved in the infection. In the dressing of these patella cases he had followed the practice of putting them up in cotton wool and firm bandage, allowing active motion when the patient was ready to move it, and no passive motion at all. Active motion is permitted as the patient turns in bed. No splint used.

DR. HERMANN FISCHER said that war experience gave a wrong picture of many of these infections and enthusiasm was carried too far. Technical procedures in infections of the knee-joint have been exhausted and the outcome depends on the virulence of the bacteria and the forces the patient has to ward these off.

DOCTOR FISCHER said he had not heard Doctor MacGuire speak of the importance of the phlegmon of the capsule and peri-articular abscesses. If there is infection of the synovial membrane without capsular phlegmon the problem is simpler and excellent results can be obtained by aspirating and washing out the knee-joint. For this purpose he prefers a 1:1000 solution of Rivanol. If there is capsular phlegmon present the joint should be opened widely. In spite of thorough drainage of the knee, these cases will often do badly, necessitating opening of the joint after Mayo or an amputation should be done.

The speaker has employed the Mayo operation in several desperate cases with gratifying results. The patients, of course, had a stiff knee, but the leg was preserved.

DR. WALTER M. BRICKNER said that for several years he had been treating traumatic synovitis, especially of the knee-joint, by aspiration and mobilization (preferably without immediate weight-bearing). It is a simple procedure which can be safely performed in the office of the dispensary and which reduces the period of disability from two months or more to two weeks or less. In his experience and in that of some other observers, the fluid aspirated in an early stage of traumatic synovitis is blood or bloody, and only after many days does it become what it is so often called, "water on the knee." One should therefore regard a traumatic synovitis as being in fact a haemarthrosis. Accordingly there must be in all these cases some tear of the joint capsule and an injury of overlying bone, cartilage or ligament. If röntgenograms are made from various angles and with great attention to secure detail there will not rarely be found, upon close scrutiny, a crack in one of the bones entering into the joint. Injury to ligament or cartilage can not be thus diagnosed röntgenographically. In a case of recurrent and persistent effusion in the knee-joint, following two direct traumata, röntgenograms showed fissure detachment of a small oval fragment of the articular surface of the lateral femoral condyle—an early stage of osteochondritis dessicans. The fragment remained in place but showed no tendency to unite under prolonged observation. Accordingly Doctor Brickner performed a free arthrotomy, which exposed not only the small osteo-chondral fragment seen in the

ACUTE KNEE-JOINT INJURIES

röntgenogram, but also a much larger and looser fragment of articular cartilage from the same condyle, which had not shown because no bone was attached to it. Probably more often than is recognized there is such a cartilage injury, especially in cases of persistent or recurrent synovitis, demonstrable only by arthrotomy or, sometimes, by pneumo-röntgenography.

DOCTOR BRICKNER agreed with Doctor MacGuire that, in spite of textbook teachings, it is not necessary to remove the entire internal meniscus when it is the seat of a tear or dislocation; the posterior portion is often firmly attached in place, and its retention appears to do no harm.

The Willems' treatment of pyarthrosis was heralded during the war as a great advance. In all the cases under Doctor Brickner's observation in the A. E. F. it was impossible to carry out the treatment because the knee infection was associated with a compound fracture of the leg or thigh. In civilian practice, too, even in cases without fracture, it is very often impossible to make the patient walk because of the severe pain and spasm. It is, moreover, doubtful that weight-bearing is desirable during active suppuration in the knee-joint, since pressure on the cartilages in the presence of infection probably encourages their necrosis. When aspiration treatment fails, or is unsuitable, what would seem to be the best plan of treatment in acute pyarthrosis of the knee is: free incision into both sides of the joint, without introducing any mechanical drains; traction to separate the joint surfaces with the knee slightly flexed on a posterior splint and the extremity suspended; removal of the traction and splint once daily or oftener for a few minutes of gradually increasing active movement in bed or, better, employment of a suspension device that does not prevent joint motion.

DOCTOR BRICKNER called attention to a two-stage method of amputation in cases of knee-joint sepsis that was employed by Doctor Blake during the war, but only recently published (*American Journal of Surgery*, April, 1925). The first stage consists in an amputation through the joint, *i.e.*, merely cutting through all the soft tissues; the second stage—amputation through the lower third of the thigh—is performed after the infection has subsided and the tissues are clean, thus avoiding the great risk of osteomyelitis and soft-part infection of the stump. At first blush it might appear that the Mayo operation, referred to by Doctor Fischer in this discussion, would accomplish the same purpose as the first stage of Blake's method. In fact, however, the Mayo operation has proven a failure and has been largely abandoned because it does not drain the infected tissues behind the knee.

DOCTOR BRICKNER asked Doctor MacGuire to tell something of the early results as to mobility after operations for patella fracture. The speaker had tried various periods for instituting movement, but after all methods he had employed it took a great many weeks to restore a range of flexion approaching ninety degrees. Stiffness was a troublesome feature whether or not motion was started early and whether the joint was bandaged in extension or in slight flexion.

DOCTOR MACGUIRE, in closing the discussion, said that operation was per-

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formed as soon as possible after admission. There was a forty-eight-hour interval for preparation. Sometimes it was four or five days before operation could be performed, but this was not through choice. If the interval was not necessary for the preparation and for taking the X-ray, operation would be done twenty-four hours after admission.

As to early motion he was not against early motion, but the capsule requires time to go through granulation. He thought the Willems' treatment was ideal, but is usually difficult to institute. If one could accomplish what Doctor Farr did with the case shown earlier in the evening, it would be the method of choice. But one occasionally gets those results without the Willems' treatment. The patients will not coöperate, and it must be remembered in the metastatic cases that one is often dealing with general sepsis. If the cartilage is injured ankylosis will result. As far as the Mayo operation is concerned, the speaker had tried it and it was a complete failure. He disagreed with Doctor Fischer about irrigation, for one can irrigate the surface wounds only. As to Doctor Brickner's remarks as to stiffness in fractured patellas, he did not get it. Extension is complete in two weeks, and these patients are walking with a cane in three weeks and have flexion to 90° in three to four weeks.

Stated Meeting Held February 24, 1926

The President, DR. WALTON MARTIN, in the Chair

ANGIOFIBROMA OF ILEUM WITH INTUSSUSCEPTION

DR. RICHARD LEWISOHN presented a man, forty-nine years old, who was admitted to Mount Sinai Hospital, May 20, 1923. He had complained of cramps in the upper abdomen for six weeks. He had vomited for two days prior to his admission. No haematemesis or melæna. Physical examination and X-ray pictures of his stomach were negative. No definite diagnosis was made. He went home June 1.

He was readmitted to the hospital one week after his discharge. He had vomited for the previous five days. He showed slight distention without visible peristalsis. No signs of fluid. An extra-rectal mass was felt in the cul-de-sac.

Two days later peristalsis was visible. A small sausage-shaped mass was felt in the right lower quadrant. It was freely movable. The rectal mass had disappeared. X-ray pictures showed hugely dilated coils of small intestine, indicating an intestinal obstruction.

Operation under gas-ether anaesthesia revealed an intussusception of the ileum, about 12 inches long. At the head of the intussusception, a pedunculated hard tumor (size of a golf ball), was palpable.

The intussusception was easily reduced. The intestine was incised in a longitudinal direction and the tumor was removed. The incision was closed transversely with two rows of catgut. Closure of abdomen in layers without drainage. Microscopical examination showed the tumor to be an angiofibroma. Patient was considerably distended during the first three days. The distention was relieved by lavage, enemas and pituitrin. He made a perfect recovery. He was discharged July 3.

It is safe to assume that the intussusception occurred soon after his first discharge from the hospital.

PRIMARY LYMPHO-SARCOMA OF THE SPLEEN

STRANGULATED INGUINAL HERNIA. RESECTION OF GANGRENOUS TRANSVERSE COLON IN PATIENT EIGHTY-TWO YEARS OLD

DOCTOR LEWISOHN presented a man, eighty-eight years old, who was admitted to Mount Sinai Hospital, December 7, 1920, with the following history: He had had a bilateral inguinal hernia for forty years. Both herniæ were always easily reducible. Six hours before his admission he noticed distention in both herniæ with acute pains. He vomited twice. No flatus was passed since the onset of the illness. Upon admission (10.30 p.m.) he showed two very large inguinal herniæ. The right side (size of a foetal head) was hard and very tender. The left side showed a soft distention. Operation done seven hours after onset of pains, under gas and oxygen anæsthesia, revealed a gangrenous transverse colon about six inches long. After the relief of the obstruction, the gangrenous transverse colon with the corresponding part of the omentum was resected. The two halves of a large Murphy button were inserted into the lumina in order to expedite the operation. Both ends were closed in three layers and a side-to-side button anastomosis was performed. The peritoneum was closed with catgut, after a small tube had been inserted into the peritoneal cavity. The skin was closed with silk sutures. No attempt was made to effect a radical cure.

The tube was removed December 15. On December 20 the patient suddenly had a severe chill with a rise of temperature to 103°. His respirations went up to 36. He had marked dyspnea and dullness and diminished breathing over the right base. His lung symptoms subsided in a few days.

The button was removed from the rectum ten days after operation.

He left the hospital January 3, 1921, and has been in perfect health since the operation.

DOCTOR LEWISOHN presented the patient in order to show that even in advanced years primary resection of the intestines can be performed with perfect recovery.

PRIMARY LYMPHO-SARCOMA OF THE SPLEEN

DR. WALTER A. SHERWOOD presented a woman of fifty-six years of age, who entered the Brooklyn Hospital because of weakness, loss of weight and the presence of an abdominal tumor, which had first been noticed two years previously.

On examination, there was a large, firm mass filling the left side of the abdomen and flank. It extended from the upper limit of the abdominal cavity well below the umbilicus, and corresponded to the outlines of an enormously enlarged spleen. The liver was of normal size and the patient was not jaundiced. There were a few scattered hard lymph-nodes in the inguinal and cervical regions, and one of these removed for biopsy showed nothing other than inflammatory changes. The patient had lost considerable weight and looked cachectic. The urine was negative and examination of the blood showed 60 per cent. of haemoglobin, 3,720,000 red cells, 23,700 white cells with 74 per cent. polymorphonuclear, 24 per cent. small lymphocytes and 2 per cent. large lymphocytes. A liver function test was of no value.

January 29, 1926, the abdomen was opened through a long right rectus incision. The tumor was found to be a very large nodular spleen of firm consistency and adherent to the diaphragm above and to all surrounding structures. There was marked perisplenitis in all directions. After separation of the adhesions, the tumor was readily delivered, its pedicle ligated and the mass removed. Except for a small subserous myoma of the uterus, no other pathology was found.

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The patient made a prompt and satisfactory recovery, and since leaving the hospital has gained seven pounds in weight and feels and seems perfectly well.

Subsequent X-ray studies of the chest showed no evidence of metastases.

Pathological Report.—Weight of tumor, 1,650 grams. Measurements, 29 cm. length; 15 cm. width; 13 cm. thickness.

The surface of the tumor is covered with large yellowish nodules, from one to four cm. in diameter. On section, very little splenic tissue is seen, this being replaced by soft yellowish-gray growth, consisting of confluent nodules.

Microscopic section showed immature lymphocytosis with numerous mitotic figures. There are extensive areas of necrosis. The appearance of the specimen both in the gross and microscopically is typical of lymphosarcoma and, according to the pathological classification of splenic sarcomata, this is the type which does not metastasize early.

SARCOMA OF INTRA-ABDOMINAL TESTICLE

DR. WALTER A. SHERWOOD presented a man, twenty-four years of age, who entered hospital because of severe pain in the right lower abdominal quadrant and sacral region. He had been having attacks of pain for five months previous to his admission. He states that he has had an enlarged abdomen for several years.

On examination, he was found to have a large firm mass about the size of an adult head which filled the lower right side of the abdomen. The tumor seemed fixed, especially the lower portion of it; was slightly nodular, and in places seemed semi-fluctuant. Further examination revealed the fact that the both testicles were undescended.

The patient was submitted to complete X-ray and urological studies with the following result: Constriction of the right ureter with moderate hydro-nephrosis, probably due to outside pressure. The ileum was massed against the caecum which was dilated and pushed upward, probably also from pressure.

December 12, 1925, the abdomen was opened through a long right rectus incision, exposing a large irregularly shaped tumor about the size of an adult head. Although it appeared to be intra-peritoneal it was covered in front by a thin layer of parietal peritoneum and was attached by a broad base to the site of the internal inguinal ring. Numerous loops of bowel were adherent to it above and the bladder was attached to its lower and inner surface. The bladder, intestines, and all adhesions were carefully separated, the tumor was dissected away from its base at the site of the internal ring and the whole mass readily removed. Considerable bleeding from numerous large veins was easily controlled. The raw surfaces were covered by suturing the peritoneum. The left testicle was found entirely within the abdomen. It was of normal size and contour. The patient made a prompt and satisfactory operative recovery.

Pathological Report.—The specimen is a large neoplasm measuring 16 x 14 x 13 cm. The anterior surface is covered with large veins and a thick white icing. The growth is well encapsulated. On section a small cyst was found, 5 cm. in diameter, which contains chocolate brown fluid. The remainder is solid and fleshy in consistency and yellowish-white in color. There is a suggestion of testicular tissue in the lower portion of the tumor, surrounded by areas of yellow and green necrosis.

Microscopical section shows a malignant growth with alveolar arrangement. The alveoli contain large conical cells not unlike epithelial cells. There is a considerable amount of stroma. Necrosis is seen everywhere. No normal testicular structure is found.

SARCOMA OF INTRA-ABDOMINAL TESTICLE

While the examination of the section suggests large round cell sarcoma, the tumor in all probability belongs in the class of so-called teratomata.

DR. WALTON MARTIN said that this type of tumor had the interesting peculiarity of apparently disappearing under X-ray treatment. He had seen several very large inoperable tumors of this character disappear in this way, but after a variable length of time they all recurred.

DR. ALEXIS V. MOSCHCOWITZ said that in his experience, the condition as presented by Doctor Sherwood is a very rare one, in spite of the fact that it is usually stated in text-books that one of the great dangers of undescended testis is malignant degeneration.

With reference to X-ray therapy in these cases, as stated by Doctor Martin, Doctor Moschcowitz mentioned a patient who is now under observation in Mt. Sinai Hospital. The man had a seminoma of the right descended testis and peculiarly, very large intra-abdominal metastases to the left of the spinal column.

The tumor was ablated, and subsequently, the patient was turned over for X-ray therapy, under which the tumor gradually disappeared. He was presented at one of the Mt. Sinai Hospital clinical conferences as a remarkably good result of X-ray therapy. He returned to the hospital about three months ago with a large hernia on the left side. Doctor Moschcowitz operated this hernia and the ring was so large that he was able to introduce a hand into the abdomen for the purpose of palpation, and numerous very large metastases were found, showing that either they were mistaken in the excellent therapeutic result of the X-rays or that the results were only temporary.

DR. JOHN DOUGLAS said that before giving the X-rays all the credit for the improvement in Doctor Moschcowitz's patient he wished to cite one case. Seven years ago he went on duty at Bellevue Hospital where there was a case which had been operated on for a large abdominal tumor. The tumor was so large that it had caused pressure on the sigmoid and rectum, and at operation the intestine was injured and the patient developed a fecal fistula. The man was apparently hopeless and the speaker did not examine him carefully until it was noticed that he was getting better. Then he carefully examined and it was found that he had a tumor of the testicle. The abdominal tumor was getting smaller. The testicle was removed and the man was discharged having gained thirty pounds in weight and no abdominal mass could be felt. Apparently all the metastases had disappeared. Less than a year afterward he was admitted to one of the medical wards with recurrence. He died shortly afterward. Another man was operated on for a small seminoma of the testicle about a year ago. There were no enlarged glands or evidences of metastases. He went home to Richmond, had abdominal pain, was treated with X-rays and died last month, a year after operation, with metastasis in the lungs, all through the abdomen and a large one in the region of the kidney. These tumors of the testicle are evidently very malignant.

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DR. JOSEPH WIENER said that a few weeks ago he was called to see a patient who had been tapped for hydrocele and found a tumor in the scrotum. This was diagnosed as malignant and removed. A few days later he obtained the man's history. He was then twenty-eight years of age, and until the age of twenty-six the testis had been intra-abdominal. At twenty-eight he had sarcoma.

CANCER OF RECTUM: EXCISION IN 1911; LATE RESULT. CHRONIC ASCITES AFTER THIRTEEN YEARS; NO LATE METASTASIS. TALMA OPERATION. CURE

DR. WILLY MEYER presented a man, who fifteen years ago, at the age of thirty-two, years, had carcinoma of the lower portion of the rectum inclusive of the anal ring. Radical extirpation was done. There was no preliminary colostomy. The anal sphincter muscles having been completely removed the stump was left one-half inch below the level of the skin and the wound allowed to granulate and cicatrize around the rectum. The patient made a good recovery. The pathological diagnosis was adenocarcinoma.

In December, 1924, he came under the speaker's care again with a tremendous ascites, anasarca of the abdominal wall, and extreme swelling of both lower extremities. At the anus was a circular, not constricting cicatricial opening which was too small for a finger to pass through, but which did admit the tip of a fountain syringe which was used every morning and the large intestine washed out. In this way he kept clean during the day and was not annoyed in the least. He had lived comfortably this way until this pronounced ascites had developed. Having been received into the hospital tapping evacuated seven quarts of fluid, which contained no cellular elements. The liver was not enlarged; in fact it seemed to be smaller than normal. The spleen too was not enlarged. There were no palpable nodular masses in the abdomen. He was not addicted to alcohol, had had no specific disease, and no malignant disease appeared to be present. Careful X-raying of the gastrointestinal tract revealed a band which pulled the greater curvature of the stomach up and a condition suspicious of malignancy. By abdominal section, several more quarts of fluid were removed. Further exploration of the abdomen failed to reveal any trace of malignancy. The liver was smaller than it is normally and was slightly granular. A Talma operation was done. The lower part of the peritoneal wound was left open, a piece of omentum pulled through, fastened to peritoneum and subcutaneous tissue and then the opening in the skin closed. To hasten anastomosis the abdomen was exposed to superheated air, with an electric cradle for half an hour every day. Before he was discharged in February he had to be tapped once more, three weeks after the Talma operation. After returning home his wife carried out the treatment with superheated air. The ascites decreased gradually, but continually. He is now entirely well and has returned to work. There is no sign of malignancy. As to the cause of the ascites as it must be referred to, some kind of chronic hepatitis, not due to alcohol nor late malignancy nor syphilis. The fact that there is not a trace of fluid in the peritoneal cavity at present speaks definitely against a ventral, intrahepatic form of malignancy of slow growth.

OSTEOMYELITIS OF FEMUR

DR. JOHN A. HARTWELL presented a patient whom he had shown before the Society, April 12, 1922. (See ANNALS OF SURGERY, vol. lxxvi, pp. 289-290.) At that time the diagnosis was doubtful and he had requested suggestions as to the most advisable therapeutic measures. Doctors Hitzrot and Whitman stated their belief that the patient's lesion was a low grade infectious

ROUX Y GASTRO-ENTEROSTOMY

osteomyelitis of the femur and advised operative intervention. Doctor Meyer expressed the opinion that the condition impressed him as tuberculosis of the bone upon a congenital luetic basis.

The patient was returned from the meeting to the hospital where she continued to run a fever varying between 99° and 100°. By August 18, 1922, there appeared a small abscess on the inner aspect of the right lower thigh. This was incised and one ounce of thick yellowish purulent exudate evacuated. The culture of this pus showed a pure growth of *staphylococcus aureus*. A thirteen centimetre sinus was found to extend upward and posteriorly from the opened abscess, but a communication with bone was not demonstrated. X-ray at this time showed a marked osteomyelitis of the entire shaft of the right femur with irregular new bone formation. There was evidence of small cloacæ at the junction of the upper and mid-thirds in the posterior aspect of the femur in the centre of which appeared a small sequestrum.

October 6, 1922, the lower six inches of the shaft of the femur was exposed through an eight inch incision on the anterior aspect of the thigh. The soft parts were moderately oedematous and the periosteum greatly thickened. Upon reflecting it from the bone, the latter presented an irregularly moth-eaten appearance and a definite sinus about two inches above the upper limit of the knee-joint. The marrow cavity was exposed by removal of the anterior cortical bone and several sequestra extracted. The sinus opening on medial aspect of the lower thigh was found to communicate with a cloaca in the lower third of the femur posteriorly. The wounds were irrigated with Dakin's solution by the Carrel technic. Healing was rapid and complete except for two small sinuses. X-ray showed two sequestra as the causative agents of these sinuses. November 21, 1922, four sequestra, each about 2 cm. in length, were removed by reopening wound of preceding operation. Following this the wound granulated satisfactorily and healed completely by January 18, 1923. From then until now, it has remained healed and she has been able to follow her occupation as stenographer without interruption. Flexion at her right knee is restricted to 75°.

DR. WALTON MARTIN said that the incision used by Doctor Hartwell had been referred to in an article on the "Anatomical Approach to Long Bones" by Professor Thompson eight or nine years ago as the incision of choice for exposing the shaft of the femur.

DR. FREDERIC W. BANCROFT said that a year ago he had a case of osteomyelitis in a woman who had been operated on in Italy twenty years previously by the incision on the anterior surface of the thigh as described by Doctor Hartwell. She had been well during all this time until last fall when she had an acute recurrence of the old process in the femur.

ROUX Y GASTRO-ENTEROSTOMY

DR. CHARLES L. GIBSON presented a woman, aged forty-nine years, who had suffered from severe stomach manifestations for many years. Fourteen years ago a gastrostomy was performed, following which she was improved until four years ago, when recurrence of troubles necessitated a posterior gastro-enterostomy. Little relief, and in past three months conditions worse than ever, vomiting daily.

On admission to the Medical Division, New York Hospital, she was greatly emaciated, vomiting frequently, and there was apparently complete pyloric obstruction. Imperfect fluoroscopy showed an enormously dilated stomach with nothing passing into the duodenum.

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Operation January 27, 1926. Local anaesthesia of abdominal wall. Six inch incision through the scar in the right rectus muscle. The abdomen was filled with adhesions, particularly of the anterior portion of the stomach to the abdominal wall and the stomach, duodenum, liver and gall-bladder presented diffuse matting from adhesions. Passing to the left side of the abdomen, access to the posterior wall of the stomach was obtained through a slit in the gastrocolic omentum. The no loop gastro-enterostomy found to be entirely closed. As it was not possible to use the transverse mesocolon or the anterior wall of the stomach, the latter was pulled out through a slit in the gastrocolic omentum and the ileum divided about eight inches below the site of the gastro-enterostomy. Distal end implanted into the side of the posterior wall of the stomach. Enterostomosis made by passing half a Murphy button down this leg, connecting it with the other half in the proximal portion with purse-string suture. Gastro-enterostomy made with aid of clamps. Five rows of sutures—all catgut. Time one hour fifteen minutes.

Convalescence was absolutely uneventful. Patient never vomited and was put on a fairly liberal diet quite early. She was allowed up on the twelfth post-operative day and went to the country on the eighteenth post-operative day. She had already gained ten pounds.

This case is one calling particularly for unusual procedures, and the situation was effectively met by a Roux gastro-enterostomy, using the gastrocolic omentum for access to the posterior wall of the stomach.

CHOLECYSTENTEROSTOMY FOR CARCINOMA OF THE BILE DUCTS

DR. CHARLES L. GIBSON presented a man, age sixty-three years, who was admitted to hospital with rather vague history of having had chilly sensations and slight feeling of nausea for about two weeks. Recently the stools have been light colored, urine dark, and jaundice was noted. Icterus index first 107, second 103. Liver function test showed dye retention of 100 per cent. Graham test showed no signs of visualized gall-bladder. Fluoroscopic examination of stomach and duodenum negative.

Operation November 17, 1925. Oblique incision. Gall-bladder was tense, thin and adherent at its lower portion to the omentum. Palpation showed no stones. On the anterior surface of the gall-bladder was a localized thickening of the wall. It could be distinctly seen and felt. It was quite firm and about a half inch in diameter. In the common duct, just below the cystic duct, was a similar thickening, also apparently in the wall. Believed that the condition was one of carcinoma of the ducts and gall-bladder, therefore cholecystectomy unsuitable. Cholecystenterostomy was done, using the jejunum about twelve inches from its origin. Five rows of suture, three posterior, two anterior, all of fine chromicised catgut. Closure of the wound without drainage.

Except for an acute bronchitis with distressing cough convalescence was smooth. Allowed up on the fifteenth post-operative day and sent to the country on the twentieth post-operative day. At that time the jaundice had all disappeared and patient was very well. Icterus index 26.

Seen January 20, 1926. Feels absolutely well.

The fact that the patient has improved so very distinctly must necessarily raise some doubt as to the nature of the obstructive process. Owing to the mechanics of the condition, namely involvement of the wall of the common duct, it seemed as if there could be little doubt as to the advisability of the procedure employed. Anastomosis of the biliary passages to the intestine have been satisfactory in the reporter's hands. Contrary to the practice of most operators, he does not attempt to make an anastomosis between the biliary passages and the duodenum, as the operation is more difficult and there is more

CHOLECYSTECTOMY WITHOUT DRAINAGE

strain on the suture line, jeopardizing its integrity. He had performed quite a number of these anastomoses, using the jejunum, bringing it up in a loose loop anterior to the colon. He knew of no instance where there had been any infection of the liver. In one case, certainly, ten years after operation there was no evidence of any trouble.

The society may remember the presentation of a case of anastomosis of the hepatic duct with the jejunum at the meeting in January, 1922. The patient is still, five and a half years after operation, in perfect health.

DR. ALEXIS V. MOSCHCOWITZ said that the subject of cholecystenterostomy for carcinoma of the common duct and the head of the pancreas has been frequently discussed at the meetings of the New York Surgical Society. Personally, he had refrained from discussing it before, but the operation did not appeal to him, and he did not believe it was frequently justified. He always tried to make the diagnosis in advance, and when he could, with a fair degree of certainty, make a diagnosis of carcinoma of the common duct or of the head of the pancreas, he did not operate at all. These patients do not stand even an exploratory operation well. The case Doctor Gibson presented, however, was perfectly wonderful, but personally whenever the speaker had performed this operation for this condition he had always regretted it.

CHOLECYSTECTOMY WITHOUT DRAINAGE

DR. CHARLES L. GIBSON presented a woman, aged twenty-eight years, who was admitted to hospital November 10, 1924, and subjected to operation November 13, by a six inch incision running well up in the epigastrium, which exposed a gall-bladder enlarged, thickened, filled with large stones, the site of a recent inflammation, especially noticeable at its neck, where all the structures were found fused into an inflammatory mass. Retrograde cholecystectomy was done after exposure of the ducts. The cystic duct was divided separately by cautery. The gall-bladder shelled out of its bed with little bleeding; the fissure of liver was sewed together to stop any oozing. Operative field left perfectly dry. Stump of cystic duct covered by flap of gastro-hepatic omentum, ligatures on the duct being led through this structure.

Recovery was remarkably serene and quiet and rapid. She was up on ninth post-operative day. Home on eleventh post-operative day. Wound healed by primary union.

Follow-up Note.—February 18, 1926. Gained twelve pounds in weight. Looks exceedingly well. No complaints. Excellent. No hernia.

A second case was presented in the person of a woman, aged twenty-six years, who was admitted March 27, 1925.

Operation was done April 4, 1925.—Oblique incision parallel to right costal margin. Gall-bladder somewhat thickened and irregular and contains numerous stones. Easily removed by retrograde cholecystectomy. There was no oozing and gall-bladder bed was closed by suture. Stump of cystic duct divided by cautery and buried in small flap of gastrohepatic omentum. Appendix pathological and removed. Closure without drainage.

Convalescence.—Complicated by some nausea and indigestion for first five or six days. This, however, cleared up and patient was discharged cured on twelfth post-operative day.

Follow-up Note.—February 18, 1926. Excellent result. No complaints. No hernia.

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AIDS TO CHOLECYSTECTOMY

DR. CHARLES L. GIBSON read a paper with the above title, for which see page 618.

DR. ALEXIS V. MOSCHCOWITZ said he had a profound admiration for anybody who ventured to do cholecystectomy without drainage. Personally he never did it, for he was very old-fashioned. He remembered a time when one of his associates was operating on two gall-bladder cases and exclaimed, "Some day I am going to have courage enough to close up a gall-bladder case without drainage." It was just as well he had not yet acquired this courage for both these cases he was then operating on were later followed by profuse drainage of bile. It would certainly have been wrong to have closed them. Doctor Moschcowitz said his patients are usually discharged at the end of the fifteenth to the seventeenth day with the wound completely healed, even though drained; he therefore sees no reason for changing his method of procedure.

DR. DEWITT STETTEN said that he was in complete agreement with all that Doctor Gibson had said. He was particularly interested in the question of cholecystectomy without drainage, and had recently published a brief paper on the subject (*Surgical Clinics of North America*, April, 1925, vol. v, No. 2, pp. 489-498). Although he was aware that the consensus of opinion was against this procedure, he felt that in suitable cases it was preferable to drainage. Without going into detail, a few of the most obvious advantages might be mentioned, such as avoidance of post-operative peritoneal adhesions; diminishing of the danger of post-operative ventral hernia; less complicated conditions if the necessity for re-operation arises; simplified after treatment and more rapid convalescence; less discomfort to the patient and avoidance of reaction from drain removal such as rise of temperature, or pulmonary infarct which Doctor Stetten has noted in one case; and finally avoidance of retention after drain removal which he has observed in several instances. His efforts have been directed toward developing a technic which would make the closure without drainage after removal of the gall-bladder as safe as possible, and this has been accomplished by the formation of a triangular peritoneal flap from the gall-bladder to cover the cystic duct stump. This flap is included in the peritoneal suture of the liver bed of the gall-bladder. The cystic duct stump is thus sealed in such a way that if the ligatures should be exploded from the cystic duct stump, which is after all, the main danger of closure without drainage, the worst that could possibly happen would be a subhepatic extra-peritoneal accumulation of bile. This could cause no serious disturbance, and could readily be taken care of if necessary. Doctor Stetten is certainly opposed to the taking of unjustifiable risks, and it must be admitted that, in a large number of cases, closure without drainage is inadvisable. Roughly in Doctor Stetten's personal experience, about 50 per cent. of his cases required drainage. The speaker has performed the operation without drainage in about 100 cases since he first began using this technic and has had no trouble in any case. Doctor Stetten also wishes to register his approval of Doctor Gibson's attitude in regard to the performing of cholecystectomy from above downwards. He

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feels that this is the logical method, permitting of traction and better exposure of the deeper parts, and that the removal of the gall-bladder from the cystic duct upwards is unsound and dangerous, as it exposes the hepatic and common bile ducts to possible injury.

DR. JOHN A. HARTWELL said he was reminded of what Doctor Judd had said of cholecystectomy without drainage: "It is a questionable procedure even though I have had no trouble with 1500 cases on which I have operated without drainage." Nevertheless, Doctor Hartwell could not see that it had any advantages to overcome the great risk it entailed and which all surgeons feared. It was perhaps advantageous if the gall-bladder was not inflamed or only slightly so and one had stones only to deal with. But there is almost always inflammation present and the trauma necessary in performing the operation may be sufficient to start up increased inflammation, and as a result there is a swelling in the common duct and temporary obstruction and back damming into the liver. One is not giving drainage which ought to be in the biliary tract during healing. Doctor Hartwell goes through the anterior sheath of the rectus, draws the entire rectus outward, and makes an incision through the posterior sheath just outside the midline. This makes a good exposure and the incision may be made long enough to easily reach the appendix. The whole innervation of the muscle is left intact and hernias have been rare. If drainage is necessary it is done through a stab wound in the flank, and any leakage is carried off through this opening. Both wounds are healed at the end of three weeks.

DR. JOSEPH WIENER said that if local anaesthesia is used the field can be widened, also the percentage of the morbidity and of the mortality can be lowered. He had recently successfully performed a secondary cholecystectomy, using local anaesthesia, on an old lady of seventy-six, who had undergone cholecystotomy some years before. There is a difference in the cases. The 1500 cases of Judd were not acute. In cases occurring in fat women of middle age, where acute inflammation is almost always present, it is impossible to make closure without drainage. There is little trouble from drainage if it is done in the proper way. For the last few years the speaker's drain has consisted of a rubber glove slipped up against the liver. The objection to the rubber dam is that it is often old and brittle, but the rubber glove can always be fresh and soft. As regards the incision. For the last ten years Doctor Wiener has used the cross incision. No hernias have resulted, it is not difficult to remove the appendix, which he does in 75 per cent. of his gall-bladder cases, there is less morbidity, no post-operative obstruction of the bowel, no difficulty in pushing the small intestine back at the close of the operation, because the small intestines are neither seen nor handled if a cross incision is made.

JOINT MEETING OF THE PHILADELPHIA ACADEMY OF SURGERY AND THE NEW YORK SURGICAL SOCIETY

Held at the Jefferson Hospital, Philadelphia, February 10, 1926

DOCTOR CHARLES F. MITCHELL, President of the Philadelphia Academy,
in the Chair

LARYNGECTOMY FOR CARCINOMA OF THE LARYNX

DR. FIELDING O. LEWIS presented six cases in which he had performed total excision of the larynx for carcinoma. The longest time that had elapsed since operation was four and one-half years. The most recent case was operated upon February 6, 1926. Three of the six patients were able to talk sufficiently well to make themselves understood. All of the three said that they were able to talk better after a large meal. The technic of the operation was illustrated by lantern slides. The operation in each instance was done in one stage, and rectal anesthesia was used routinely.

DR. CARL EGGERS of New York, discussed Doctor Lewis' presentation, and said that as a general rule he favored the two-stage operation, especially where there was involvement of the lymphatics of the neck. He thought that perhaps laryngological surgeons did not have quite the same conception of lymphatic extension of malignancy as the general surgeon. He added, however, that Doctor Lewis' results spoke for themselves.

TULAREMIA

DR. JOHN B. FLICK read a paper entitled "Tularemia," containing a report of two cases.

SYPHILIS OF THE STOMACH

DR. J. STEWART RODMAN presented a colored man, aged fifty-two years, who was admitted to the Woman's College Hospital, November 9, 1925, on account of pain in stomach with vomiting for the past four months. Has lost 40 pounds in weight in the four months. Is afraid to eat on account of the pain. Bowels move regularly.

Abdomen.—Skin very dry and thin. No subcutaneous fat. Liver margin palpable two fingers below costal margin. There is a suggestion of a mass in the midline and just to the right and below the liver. Very tender over this same area. No rigidity, no other masses felt. Extremities negative but very thin. Reflexes negative. Wassermann—4 plus.

X-ray showed the greater curvature of the stomach in its upper half marked irregularity in contour, with a narrowing of lumen, evidently due to a pathological process. There is extreme tenderness over this area. The pylorus appears to be normal. The duodenal cap is large, with a filling defect on its upper border and with adhesions about the duodenum. There was no obstruction to the passage of the meal, but rather a hypermotility of the entire tract, as the whole meal was evacuated in about twenty-four hours. November 16, 1925, a laparotomy was done. On exposing the stomach it was found to be entirely occupied by a new growth from cardia to pylorus. Stomach was contracted, the growth felt hard and smooth. There was no glandular involvement either along the lesser or greater curvature. No evidence of metastasis to the liver or other abdominal viscera. Because of the fact that the entire stomach was apparently involved in the tumor mass; that the

SIMULTANEOUS BILATERAL MAMMARY CANCER

patient's condition did not warrant a total gastrectomy, and that it seemed necessary to feed him, a jejunostomy was done. The patient left the operating table in good condition.

Post-operative Record.—After the fourth post-operative day, the patient began to feel most comfortable, feeding through the jejunostomy opening having been started on the second day. At this time he was put on mixed treatment of biniodide of mercury gr. $1/32$; potassium iodide gr. 10 , three times daily. His improvement began almost at once and at the end of two weeks following operation he was able to take a semi-liquid diet without pain. His condition continued to improve and a second X-ray was taken six weeks after operation, at which time he was eating soft diet without any discomfort. This second X-ray showed a very marked improvement in that the tumor mass was apparently greatly reduced in size, and in fact the stomach, although contracted, filled with bismuth throughout. He was discharged from the hospital on the 30th day of December, 1925.

On the day of this report, February 10, 1926, his improvement has continued. He has gained about twenty-five pounds in weight, is eating any kind of food and digesting it without pain and his jejunostomy opening is closed.

In comment the speaker referred to the paper of Doctor Hartwell in the *ANNALS OF SURGERY* for April, 1925, in which Doctor Hartwell has reviewed the literature and finds since the original report of Andral in 1834 of two cases, that there have been some twenty-three others in addition to those reported by G. B. Eusterman in 1923 from the Mayo Clinic. Chiari, in 1891, in reporting two cases and in collecting seven from the literature, stated that it was his belief that only histological proof of syphilis of the stomach should be accepted. Since that time the Wassermann and X-ray have been perfected and is more to be relied on at the present time, in the writer's opinion, than histological findings in so far as syphilis is concerned.

This case is reported, therefore, as an instance of syphilis of the stomach because of (1st) the fact that he unquestionably had a tumor of the stomach as proven by clinical history, X-ray and operative findings. (2nd) That he had a positive Wassermann, it being 4 plus. (3rd) That the X-ray findings were characteristic, and (4th) of his rapid improvement under anti-syphilitic treatment.

SIMULTANEOUS BILATERAL MAMMARY CANCER

DR. EDWARD J. KLOPP presented a woman, sixty-three years of age, who noticed a lump in the left breast in March, 1924. At examination April 16, there was found in the left breast a small hard, movable nodule, about 3 cm. in diameter, in the upper outer quadrant of the left breast; no palpable nodes in the corresponding axilla. A similar mass was found in the right breast partly beneath and to the left of the nipple. She had no knowledge of this second tumor. The right axilla also was free of palpable nodes. The breasts were smaller than the average.

There had been no pregnancies. Menopause at forty-five with no unpleasant symptoms. X-ray of her chest showed no evidence of pulmonary metastasis.

May 14, the left breast was removed by the Stewart technic; twelve days later the right was likewise removed. The pathological report stated that the microscopic appearance of the tumor from both breasts of this patient shows a very marked similarity in type. They are both adeno-carcinoma, and

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the picture strongly suggests duct origin. The axillary glands of both specimens showed no microscopical evidence of metastasis.

This undoubtedly is a case of simultaneous cancer of both breasts, said to occur about once in five hundred cases.

IMPERFORATE RECTUM WITH VESICAL OUTLET

DR. EDWARD J. KLOPP presented a male child, born June 26, 1925. Birth was spontaneous. It was the sixth child. No other malformations in the family. The following day the baby was referred to the reporter at the Pennsylvania Hospital where it was admitted in Doctor Gibbon's service. The child had an imperforate anus. There was no anal dimple. The urine contained meconium. There was no discharge of meconium when the child did not void. Vomiting had not occurred.

The child was operated upon thirty-eight hours after birth. The perineum was infiltrated with $\frac{1}{2}$ per cent. procain. An incision was made in the midline extending from the scrotum to the coccyx. The sphincter muscles could not be identified. Continuing upward for at least seven cm., he failed to find bowel. Crying and struggling caused some bulging from above, but not sufficient to definitely identify large bowel. Neither did he find the communication between the bowel and bladder.

Sigmoid colostomy was done and the bowel was brought to the surface of the abdomen with difficulty, as it seemed to be fixed below. The bowel was opened and a large catheter inserted. There was a copious discharge of meconium. The catheter was removed in three days. The perineal incision was allowed to close.

Feeding presented a difficult problem. Digestion was poor, but he began to gain consistently in September, and was referred to the X-ray department for the purpose of determining the location, position and contour of the blind pouch. The röntgenologist reported that the lower opening in the colostomy corresponded with the proximal loop of the bowel. At operation it was intended to bring the bowel up without twisting or changing its direction.

December 30, with a catheter in the rectal pouch an incision was made in the perineum and dissection carried upward until the catheter was felt through the bowel. After freeing it as much as possible it was brought down, opened and sutured to the skin.

The X-ray films with catheter in both proximal and distal loops shows that the afferent and efferent portions are close together for 3 cm.

January 25, 1926, a light haemostat was applied to the spur between the two loops in order to crush the septum. Feces passed through the artificial anus five days later. The clamp was removed on the sixth day. X-ray with barium meal injected through the colostomy opening shows a slight narrowing about 6 cm. above the anus. Judging from the appearance of the shadow over the perineum there is no anal sphincter action.

The anus is about 1 cm. behind the normal location. It is doubtful whether anal sphincter action will ever develop, but is hoped that the levators will assume this function, at least in part. No attempt will be made to close the colostomy until it is found whether this procedure would be justifiable.

NERVE ANASTOMOSIS IN RECURRENT LARYNGEAL PARALYSIS

DR. CHARLES H. FRAZIER read a paper entitled "A Review of Results of Nerve and Anastomosis in Treatment of Recurrent Laryngeal Paralysis."

FECAL FISTULA

DR. JOHN B. DEAVER read a paper entitled "External Fecal Fistula Following Appendicitis."

BOOK REVIEW

THE PRACTICE OF UROLOGY. By HUGH H. YOUNG, M.D., and DAVID M. DAVIS, M.D., with the collaboration of FRANKLIN P. JOHNSON, M.D. Two octavo volumes. Philadelphia and London. W. B. Saunders Co., 1926.

These two volumes represent, indeed, a monument to the director of the James Buchanan Brady Urological Institute, and show the results that may be obtained by the centralization of effort in a single branch of endeavor. Their publication has been impatiently awaited, and certainly will repay the reader in his search for authoritative information in any one of the multitude of ramifications and interdependencies associated with a study of phenomena connected with pathologic conditions relative to the urogenital tract.

The critical study of such an enormous amount of clinical material represents unremitting labor, but the tabulation of results is very lucid, concise, well systematized and readily appreciated. The arrangement of the subject matter has been made almost entirely on the basis of the pathology. Thus in the earlier part of the work the results of obstructive uropathy are exhaustively considered, while the recitation of operative procedure is deferred for subsequent consideration, thus eliminating reiteration which would otherwise have occurred.

As must naturally have been expected, especial weight is placed on the personal achievements of the clinic and the justification of the many and various procedures, mechanical devices and original researches which have had their inception under the direction of the authors. A mere recitation of the many phases covered reads like an urologic index itself. One notes particularly the studies on the physiology of micturition, the various phases of acute and chronic cystitis, pyonephrosis and renal and ureteral calculus, pre-operative treatment of prostatectomy, etc. Various personal operative procedures as the special Bottini technic for middle lobe cases, perineal prostatectomy, punch operation, various cystoscopic operative procedures and the transperitoneal technic for kidney tumors with removal of the peritoneal covering are recited and illustrated in more than usual detail. The depiction and description of the uses of a multitude of original urologic instruments are most instructive. The efforts of Doctor Davis in developing a urinary anti-septic and the statistical presentation of the results of mercurochrome and merroxyl and the new antisyphilitic drug, flumerin, and the efforts toward the obtaining of a *therapia sterilans magna* are all taken up in detail and effectively.

The first volume, in addition to a consideration of the physiology of micturition and the lesions resulting from obstructions along the urogenital tract, devotes three chapters to infections and infestations, general, tubercular and

BOOK REVIEW

syphilitic, while the subjects of urolithiasis, prostatic hypertrophy and neoplasms complete it.

The second volume is introduced by an exhaustive treatise on malformations and abnormalities of the urogenital tract covering 136 pages, chiefly the observations of Dr. Franklin P. Johnson, whose especial aptitude and knowledge of embryology lends itself well to the proper consideration of this important subject. Chapter XII, on the diagnostic significance of special urologic symptoms is particularly interesting, and its careful reading will well repay one. Eight chapters are devoted to the operations on the kidney, ureter, bladder, prostate, seminal vesicles, scrotum and its contents, urethra and penis, respectively. All procedures are fully illustrated and the descriptive text adequate.

Interspersed throughout the two volumes in appropriate positions are many page inserts in colors showing the varying appearance of pathologic conditions in various stages, as might be seen through the cystoscope or urethroscope. They are particularly accurate and natural. The remainder of the one thousand illustrations are mostly original and show the conditions referred to perfectly. The drawings are the work of William P. Didusch and are very well executed.

The work of Doctor Young and his associates will prove beyond any question a very welcome and valuable addition to urologic literature reflecting and representing, as it does, the best American thought on a subject in which there has been such revolutionary advances during the last decade, and complementing the already noteworthy treatises of Watson and Cunningham, Guiteras, Chetwood, Keyes and Cabot.

JAMES T. PILCHER.

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